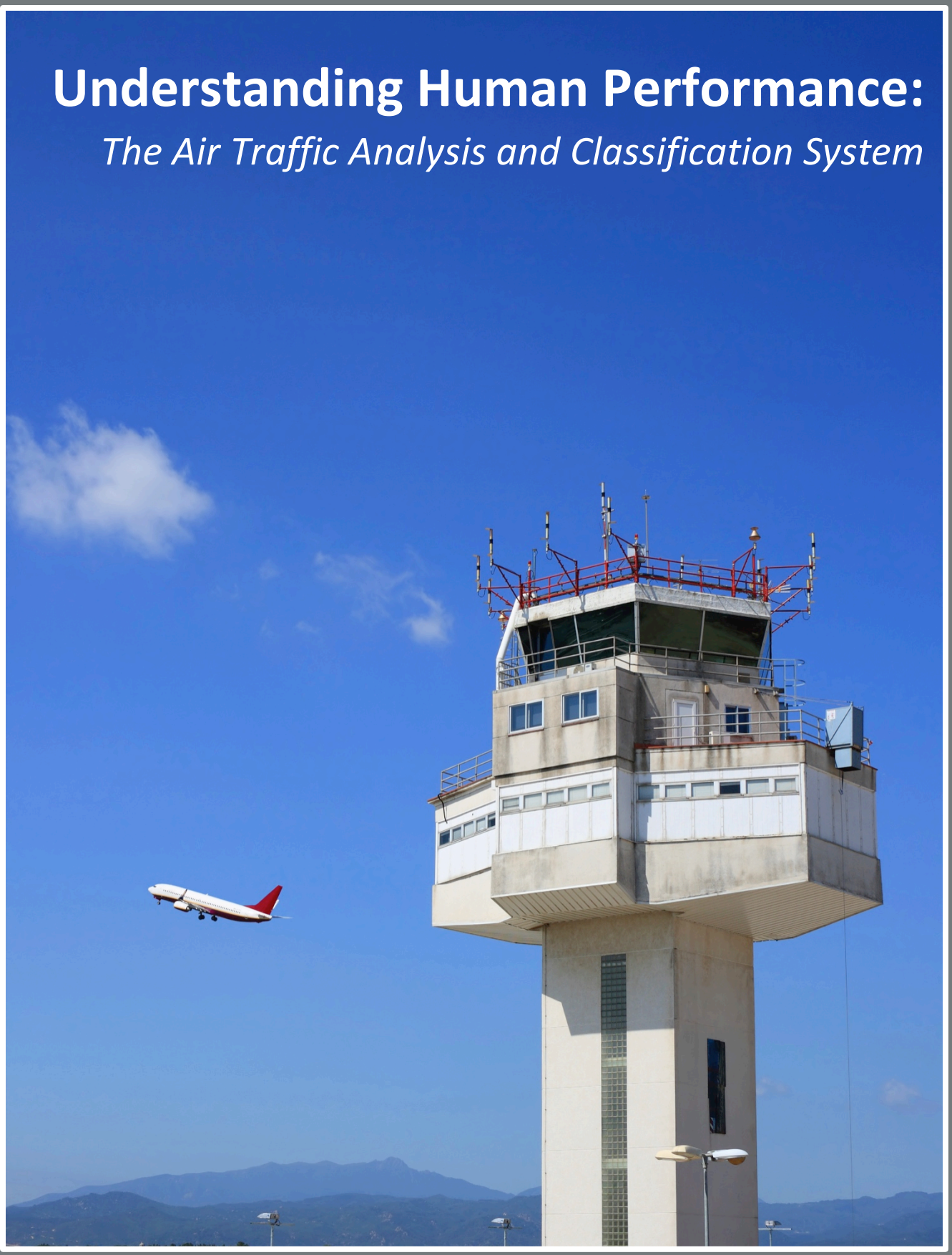
Understanding Human Performance:

The Air Traffic Analysis and Classification System



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14. ABSTRACT
Filling a need for an air traffic human performance taxonomy, the Air Traffic Analysis and Classification System (AirTracs) was developed by merging existing taxonomies to accommodate the strengths of each taxonomy while addressing their weaknesses and by introducing customized air traffic factors. The AirTracs framework promotes the identification of human factors causal trends by allowing factors from the immediate operator context to agency-wide influences to be traced to individual events while still being able to identify human factors patterns and trends. This report details the five tiers of the AirTracs taxonomy by providing factor definitions and exemplars.

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Acronyms

Acronyms	
AA	Aircraft Actions
AAL	American Airlines
AC	Agency Climate
AIM	Aeronautical Information Manual
AirTracs	Air Traffic Analysis and Traffic Analysis System
ALTRV	Altitude Reservation
APC	Airport Conditions
APREQ	Approval Request
ASC	Airspace Conditions
ASDE	Area Surveillance Detection Equipment
ASQ	Atlantic Southeast Airlines (Acey)
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATSAP	Air Traffic Safety Action Program
AWE	US Airways
AWI	Air Wisconsin Airlines
CA	Conflict Alert
CC	Communication
CIC	Controller in Charge
CJC	Colgan Airlines
CPC	Certified Professional Controller
CPC-IT	CPC In Training
CPF	Cognitive and Physiological Factors
CRJ	Canadair Regional Jet
De	Decision Act
DME	Distance Measuring Equipment
DoD	Department of Defense
EGF	Eagle Flight Airlines
EJA	Executive Jet Airlines
ERJ	Embraer Regional Jet
Ex	Execution Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation

Acronyms	
FLG	Flagship Airlines
FLM	Front Line Manager
FOD	Foreign Object Debris
GAO	Government Accountability Office
HERA	Human Error ATM
HFACS	Human Factors Analysis and Classification System
IAFDOF	Inappropriate Altitude For Direction Of Flight
IDS	Intrusion Detection System
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
JBU	Jet Blue Airlines
KE	Knowledge / Experience
KIAS	Knots Indicated Airspeed
LC	Local Control
LOA	Letter of Agreement
LXJ	Live Flexjet
MAP	Monitor Alert Parameter
MARSA	Military Assumes Responsibility for Separation
MOA	Military Operations Area
MSAW	Minimum Safe Altitude Warning
MVA	Minimum Vectoring Altitude
NAS	National Airspace System
NOTAM	Notice to Airmen
OI	Outside Influence
OJT	On-the-job Training
OJTI	OJT Instructor
OP	Operational Process
OPD	Optimum Profile Decent
PDC	Pre-departure Clearance
PDT	Piedmont Airlines
PE	Physical Environment
RM	Resource Management
RVSM	Reduced Vertical Separation Minima

Acronyms	
RWY	Runway
Se	Sensory Act
SFC	Surface
SIA	Status Information Area
SID	Standard Instrument Departure
SO	Supervisory Operations
SOP	Standard Operating Procedures
SP	Supervisory Planning / Preparation
STAR	Standard Terminal Arrival
SUA	Special Use Airspace
SWA	Southwest Airlines
TCAS RA	Traffic Alert and Collision Avoidance System Resolution Advisory

Acronyms	
TE	Technological Environment
TFR	Temporary Flight Restriction
TM	Traffic Management
TMI	Traffic Management Initiative
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control
UAL	United Airlines
URET	User Request Evaluation Tool
V	Willful Violation
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	Very High Frequency Omnidirectional Range
WX	Weather

Introduction

It is vital to successful operations of the National Airspace System (NAS) to understand the key role of human performance throughout the various layers of the system. The understanding of operational human performance safety trends is necessary in complex industries, such as air traffic control (ATC), to gain understanding of human-system operations. Figure 1 depicts the various components that are necessary for operational performance of the NAS. If one cog of the operational performance wheel is missing, success may be hindered.

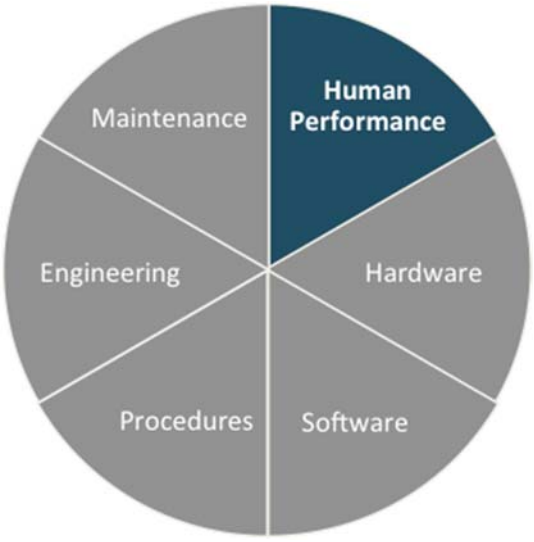

Figure 1: Components of Operational Performance

In addition to impacting current day operations, insight into operation human performance has the potential to impact the designs of future systems to improve NAS efficiency, safety, and performance. Providing designers with knowledge of the current operational human performance trends in a system permits designers to incorporate mitigations aimed at those trends into the earliest stages of concept development (GAO, 2011). Like the other components of operational performance, human performance is driven my many underlying factors (Figure 2), such as the individual's knowledge and experience, the team members, the work environment, facility management, procedures, agency policies, and many other factors.

Figure 2: Sample Factors Impacting Human Performance

This workbook will present an ATC-centric human performance taxonomy, the Air Traffic Analysis and Classification System (AirTracs). Applying a human performance taxonomy will allow for a deeper understanding of human performance and how those underlying factors can impact human and system performance. After reviewing this workbook, the associated PowerPoint quizzes, and accompanying training, you will be ready to apply the AirTracs to gain more insight into operational human performance.

A Human Performance Success Story: Humvee Rollovers

To illustrate the benefit of understanding operational human performance, a case study of a safety event and the aftermath of the investigation will be presented (Jennings, 2008). On November 17, 2005, a convoy of four armored M-988s (Humvee) (see Figure 3) set out on a 50-kilometer mission in Iraq. During the last third of the mission, the convoy would potentially be passing through hostile territory. Forty-five minutes after the start of the mission, the driver of the second M-988 swerved on a curve in the road. The driver lost control of the vehicle, and the M-988 rolled over. Unfortunately, one of the soldiers was ejected and killed.

Figure 3: Standard M-998 Humvee Used By Operator During Training

A human performance investigation (Jennings, 2008) was conducted to identify the human performance factors and the underlying associated factors in an attempt to prevent similar incidents from occurring in the future. The human performance investigation utilized the Department of Defense's (DoD's) Human Factors Analysis and Classification System (HFACS) as a basis for identifying factors at the human operator level, the preconditions for unsafe acts level, supervision level, and the organizational level (DoD, 2005). [Note: More information regarding HFACS is contained in following sections.]

Human Performance Investigation

While the full results of the investigation can be viewed in Figure 4, the individual factors will be explained. The investigation identified that the driver of the vehicle lost control (Factor A). The deceased occupant failed to secure his seatbelt (Factor B). Without a methodological taxonomy to perform an accident or incident investigation, many accident investigators would have completed the investigation with only these two operator factors to denote the event. However, the human performance taxonomy of HFACS assists the investigator in identifying the underlying factors that are associated with event. Additional understanding to the underpinnings of human performance allows for the investigators to develop informed and targeted mitigation strategies to prevent future similar accidents or incidents.

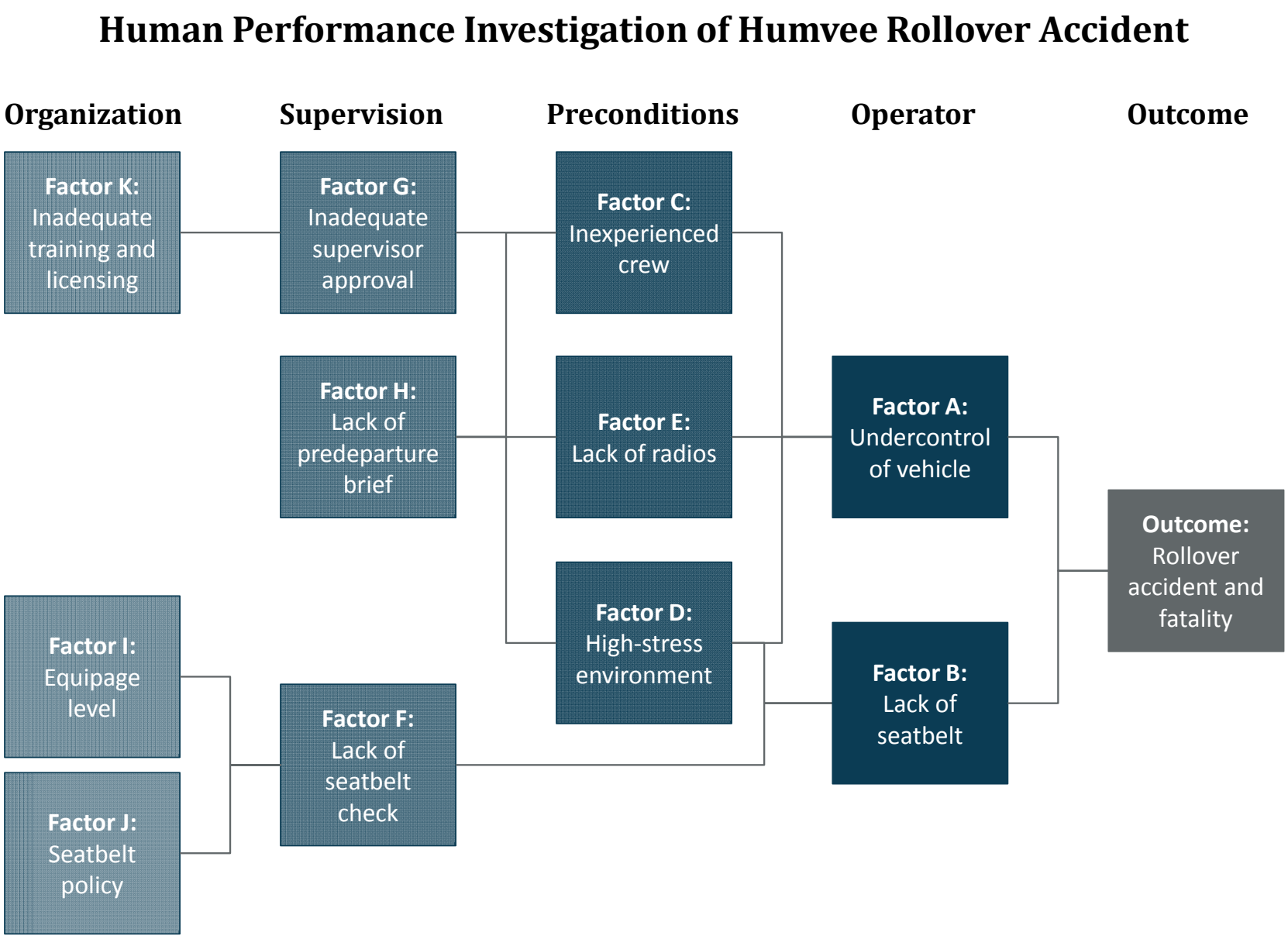

Figure 4: Human Performance Investigation: Case Study

When examining the event in more detail, the investigator was able to determine that the crew of the vehicle, including the driver, was inexperienced having been in Iraq for less than two months (Factor C). The driver had not driven the heavier version of the M-988 in use that day (Figure 5) since his arrival in Iraq. Obviously, this was no ordinary traffic accident. The accident occurred in the middle of a war zone where enemy fire and improvised explosive devices are not uncommon, resulting in a high-stress environment (Factor D). Additionally, the convoy did not have enough radios to support the full mission causing the second M-988 to operate without a radio, which means they had no way to quickly and reliably communicate with the rest of the convoy (Factor E).

Figure 5: Heavier Version of M-988 with Higher Center of Gravity

Beyond the roles of the convoy members, the role of the convoy supervisor was examined to determine the impact of supervisory techniques and decisions on operational human performance. The senior member of the convoy was in charge of the seatbelt usage and did not conduct a seatbelt check (Factor F). The convoy commander was aware of the driver's experience level, but approved the driver on the second M-988 even though official guidance states that new vehicle operators should never gain initial experience in combat. (Factor G). The convoy commander, who was from a different unit, did not conduct the standard and required pre-departure briefing (Factor H). The brief should have included a mission risk assessment that informed all members of the convoy of the risk associated with the mission and mitigations for the risks.

It is also important to examine the role the overall organization in the accident to determine how organizational decisions and policies can impact supervisory and operational human performance. During the first years of the Iraq war, the early war soldiers needed to be able to exit a vehicle quickly. Therefore, M-988s were not fully armored (similar to Figure 3) even with many of the vehicles having canvas doors, sides, and tops during the first two years of the war. Many of these unarmored versions of M-988s had two-point seatbelts that were often not long enough to reach around a soldier wearing body armor (Factor I). Additionally, many soldiers were ordered by leadership to not wear those seatbelts to aid in quick egress from the vehicle (Factor J). Due to the inadequate seatbelt equipage and the seatbelt orders, a culture was created where soldiers were not wearing seatbelts and were not being encouraged to wear seatbelts. As the war progressed, the armored M-988s' seatbelts were improved to three-point seatbelts, and new seatbelt policies were enacted. However, the safety culture for seatbelts was already degraded due to the former seatbelt equipage and policies.

Prior to deployment in Iraq, the driver of the second convoy vehicle had only driven an armored M-988, which has a higher center of gravity, only one time during previous training in Kuwait. Prior to the Iraq

mission, the driver had only received training on the un-armored M-988. However, the Army training and licensing system allowed the driver to be licensed to drive the armored M-988, which has different handling and operating characteristics (Factor K).

RESULTS OF HUMAN PERFORMANCE INVESTIGATION

Following the investigation of this and other similar rollover accidents, many of the organizational factors identified were addressed through mitigation programs. Production of armored M-988 and similar vehicles was increased to allow for soldiers to receive more training on the higher center of gravity vehicles prior to operation in Iraq. The Army Combat Readiness Center / Safety Center enacted a change in convoy speeds to decrease to the speed to improve driver handling of the vehicle. The Center also stressed the importance of the improved seatbelt policy with the armored M-988s. When examining rollover in the following three years, it was found that rollover incidents decreased by 62% and rollover fatalities decreased by 75%.

This is just one example that illustrates how an operational human performance study can be used to extend beyond the simple, human error explanations of an accident to discover latent, hidden factors that impact operational human performance. [For more information on this case study, read Jennings' (2008) *Human Factors Analysis and Classification: Applying the Department of Defense System During Combat Operations in Iraq*.]

The Air Traffic Analysis and Classification System

Many accident and incident investigation taxonomies have been developed over the years to assist in identifying and classifying factors involved in near misses events and accidents. While these taxonomies are often used to better understand individual events, they also offer the potential for quantifying the relationships among the various factors to better understand what impacts operational human performance. Many of these taxonomies build upon Reason's (1990) model of the dynamic of accident causation (Figure 6). An accident's or incident's trajectory can be traced from the latent factors of a system to the active factors of a human operator to the system error defenses to the resulting adverse outcome. Active errors represent the operator actions that directly impact system operation and are typically associated with human error. Latent errors can represent organizational, managerial, or internal operator factors that can exist in a system but remain dormant until the correct combination of factors permit for the system's error defenses to be breached. The system's error defenses represent the various safety defenses put into place (e.g., Safety Management Systems, conflict alert) and the resilience mechanisms innate to a system or operator. The latent and active factors can be viewed as individual layers of Swiss cheese with the holes in the cheese representing gaps in system defenses. An accident or incident occurs when the holes of the Swiss cheese align momentarily.

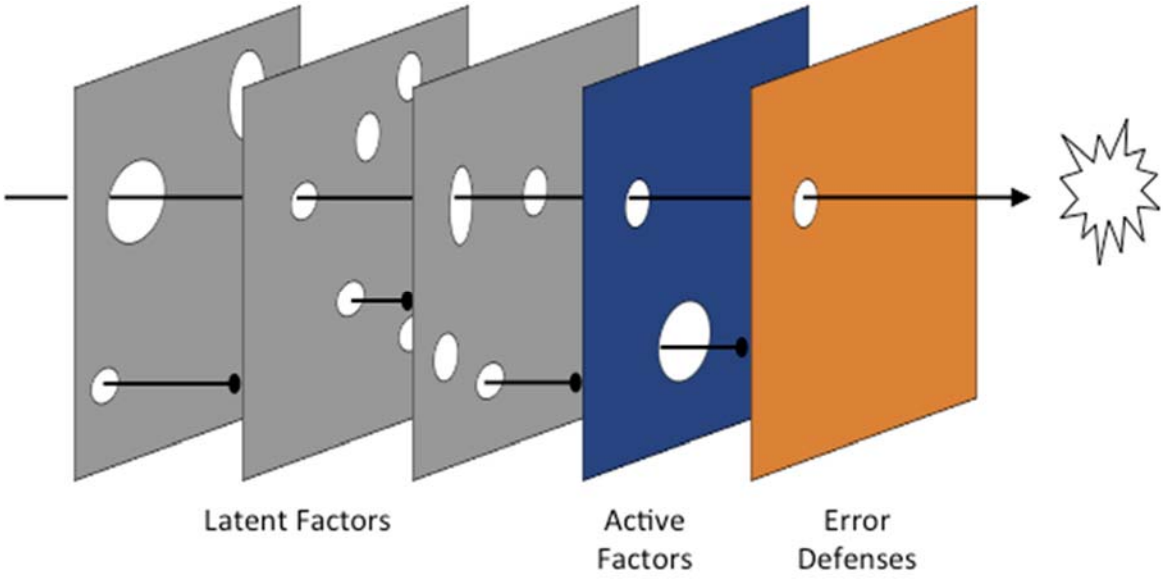

Figure 6: Reason's (1990) Swiss Cheese Model

In the air traffic domain, a comprehensive taxonomy is needed to ensure that the operator actions and underlying factors that contribute to safety events in the NAS can be identified. A domain-specific taxonomy would allow a safety professional to identify prominent safety trends and to identify and mitigate safety factors before an accident occurs. The Air Traffic Analysis and Classification System

(AirTracs) was developed to systemically and thoroughly examine both the impact of operational human performance on air traffic safety events and the impact of underlying organizational components on operational human performance. In the following sections, the taxonomies serving as the foundation for AirTracs will be discussed, and the development of AirTracs will be examined.

The Human Factors Analysis and Classification System

Fulfilling a need for a standardized accident investigation taxonomy, the Human Factors Analysis and Classification System (HFACS) taxonomy was modeled on Reason's (1990) Swiss cheese model of active failures and latent conditions (Wiegmann & Shappell, 2003). Initially designed for aviation, the HFACS taxonomy consists of one tier of active errors – unsafe acts – and three tiers of latent conditions – preconditions for unsafe acts, unsafe supervision, and organizational influence. The taxonomy provides a structured, systematic approach for investigating both accidents and near miss incidents.

Due to its origins, the HFACS taxonomy has been applied to the many facets of the aviation industry, including commercial (Wiegmann & Shappell, 2001), military (Li & Harris, 2006), and general aviation (Shappell & Wiegmann, 2004). Additionally, the application of the taxonomy has extended beyond the aviation industry to include maintenance (Berry, Stringfellow, & Shappell, 2010), mining (Patterson, 2009), and rail (Baysari et al., 2008). While the HFACS taxonomy has been applied to a wide range of industries, the level of detail needed to classify domain-specific causal factors is not present in the current HFACS taxonomy and similar generalized taxonomies. Without detailed information on the various causal factors, the mitigation strategies developed from generalized findings may lack the information needed for comprehensive and in-depth application (Pounds & Isaac, 2002).

HERA-JANUS

Developed jointly by the FAA and EUROCONTROL, the Human Error ATM (HERA)-JANUS technique was created to comprehensively examine the human factors causal factors associated with safety events specifically in ATC. The HERA-JANUS taxonomy categorizes unsafe acts through detailing the error – in terms of error type, error detail, error mechanism, and information processing level – and the context of the error – in terms of task, information and equipment, and contextual conditions (Isaac et al., 2003). The taxonomy provides a thorough and meticulous approach for investigating ATC safety events. While the HERA-JANUS taxonomy has the level of detail necessary for an exhaustive understanding of a single safety event, the technique lacks in its ability to identify systemic safety patterns. Without the ability to identify emerging trends in safety data, safety practitioners will lack the ability to develop mitigation strategies that address systemic issues (Wiegmann & Shappell, 2003).

Development of AirTracs

Generalized taxonomies, such as HFACS, are easy to understand and allow for trend analysis of broad causal factors, but can be limited in identifying domain-specific mitigation strategies. Domain-specific taxonomies, such as JANUS and HERA, may more accurately describe individual ATC events, but can have too many causal factors to provide meaningful aggregate analysis. AirTracs was developed by merging the HFACS and HERA-JANUS taxonomies to accommodate the strengths of each taxonomy while addressing their weaknesses. The framework of the AirTracs causal factor model is based on the DoD's HFACS model (DoD, 2005), while the detailed causal factor categories incorporate factors from HERA-JANUS (Isaac et al., 2003). The AirTracs framework promotes the identification of human factors

causal trends by allowing factors from the immediate operator context to agency-wide influences to be traced to individual events while still being able to identify human factors patterns and trends. Figure 7 depicts the AirTracs taxonomy. In the following section, each tier of the AirTracs taxonomy will be examined in more detail.

Figure 7: AirTracs Taxonomy

The AirTracs taxonomy was developed utilizing subject matter experts from the air traffic, flight deck, and human factors domains. First, a literature review was conducted to gather any ATC human factors and safety taxonomies. The factors from those taxonomies were then grouped into categories using a card sort methodology. The factors and categories were customized to reflect the unique phraseology or terminology of ATC. The taxonomy was applied to Aviation Safety Report System (ASRS) safety event reports using a consensus methodology to identify any gaps in the taxonomy. Based on the results of the application, the AirTracs taxonomy was refined to eliminate any major gaps and to reflect potential NextGen capabilities.

Similar to the HFACS taxonomy, the AirTracs model follows a tiered approach. The first tier – Operator Acts – addresses those factors most closely linked to the actual safety event and describe the actions or inactions of the operator. Operator Acts factors are classified as Willful Violations or Errors, with Errors being categorized as Sensory, Decision, or Execution. The second tier – Operating Context – describes the immediate environment associated with the operator and the safety event. Operating Context factors are classified as Controller Workspace, which is categorized as Physical Environment and Technological Environment; Controller Readiness, which is categorized as Cognitive and Physiological Factors and Knowledge/Experience; and NAS Factors, which is categorized as Airport Conditions, Airspace Conditions, Aircraft Actions, and Coordination and Communication. The third tier – Facility Influences – describes the factors related to the actions or inactions of individuals at an ATC facility that have the ability to impact the whole facility or multiple individuals at a facility. Facility Influences factors are classified as Supervisory Planning, Supervisory Operations, and Traffic Management. The fourth tier – Agency Influences – examines those factors related to the actions or inactions of the agency (in this case, the FAA) and is classified as Resource Management, Agency Climate, and Operational Process. The underlying factors in each of the tiers and categories will be described in the next section *Applying AirTracs: A Tutorial*.

THE AIRTRACS CLASSIFICATION PROCESS

Upon completion of this workbook, associated materials, and AirTracs training, individuals can participate and conduct AirTracs assessments of operational human performance. The assessment facilitator should gather safety event reports from safety event databases, such as the Air Traffic Safety Action Program (ATSAP) and Aviation Safety Reporting System (ASRS). The reports should be imported into the AirTracs database or similar database.

For each assessment, a panel must be created of at least three subject matter experts who have been trained in AirTracs. The experts must include representatives from the fields of human factors and air traffic control, and if necessary, the panel should include experts from the flight deck and traffic management domains. The panel should review each safety event report to determine the factors present in each individual report at all five AirTracs Tiers. For each report, there will often (but not necessarily always) be factors at every tier as well as multiple factors within each tier. Each of these factors will then be classified with AirTracs factors once consensus is reached among the panel. When a factor is identified, the panel should classify the factor with an AirTracs factor, classification level, factor reasoning, and factor actor. The AirTracs factors will be discussed in greater detail in the following sections. The factor reasoning should include text from the narrative describing the AirTracs factor from the safety event narrative.

The factor classification level (Table 1) describes the degree to which the factor impacts the outcome of the safety event. The classification level groups are Adverse, which describe factors impacting safety in a negative manner; Observed, which describe factors that occurred during the safety event but do not directly play a role in the event; and Positive, which describe factors impacting safety in a positive manner. The Adverse group includes the levels causal and contributory. A factor identified as causal is a factor that directly and immediately impacts the outcome. For example, if a driver failed to see a stop sign and had a car accident, the factor of failure to see the stop sign is causal. A factor identified as contributory is often a latent factor, which has the ability to impact human and system performance indirectly. For example, if the driver was fatigued, failed to see a stop sign, and had a car accident, then the factor of fatigue is contributory. The fatigue did not cause the car accident but did increase the likelihood of not seeing the stop sign.

Table 1: Classification Levels

Classification Level		Level Definition
Adverse	*Causal*	An immediate/direct factor that identifies an active error or failure of critical components of equipment, systems, or human error. *Causative: If "A" occurs, then "B" will occur.*
	Contributory	An underlying/root factor that identifies latent errors or failures related to human performance, operating environment, task procedures, training, supervision, or policy that influence the presence of causal factors. *Probabilistic: If "A" occurs, then the probability of "B" occurring increases.*
Neutral	*Observed*	A factor that is present but the associated impact of the factor on the safety event has not been established. It is recorded to note its potential influence on the event or actors involved and to be incorporated into trend analysis.
Beneficial	*Positive*	A factor that positively contributed to the safety of an event. This can include factors or actions that contributed to the detection of or recovery from an adverse outcome.

Upon completion of the AirTracs classification process, the panel members should initiate the analysis of the classification assessment. The AirTracs Analysis Process will be described in more detail in supplementary workbooks. The AirTracs Analysis Process will incorporate statistical tests and measures, whose results will be utilized to develop human factors recommendations.

Applying AirTracs: A Tutorial

In this section, the AirTracs factors will be defined for each AirTracs tier. Following the factor definitions, examples for the AirTracs factors from de-identified safety event reports will be presented. Each of the five tier descriptions will also include a short factor quiz with the answers following.

Operator Acts Factors

The first portion of the tutorial will focus on the active factor tier – Operator Acts. Operator Acts are those factors or actions that are most closely linked to a safety event and are described as the actions or inactions committed by the operator. Operator Acts are divided into acts and violations. Acts are the mental or physical activities of the operator associated with the outcome of the event or the recovery from the event. Errors or adverse acts are unintended and are not associated with negative motivations. Errors are numerous and a part of everyday life due to human nature. Benefits or positive acts are those actions related to the successful recovery from or response to an adverse event or condition. Acts are classified as either sensory, decision, or execution. Violations are the actions of the operator that represent a willful and knowing disregard for the rules and regulations. Unlike acts and errors, violations are willful and deliberate.

Figure 8: Operator Acts

Sensory Acts

Sensory Acts occur when the controller misinterprets information that is presented visually or audibly. Adverse sensory acts occur when a controller's sensory input is degraded, and a plan of action is developed based upon faulty information unknowingly making the plan inadequate. Positive sensory acts occur when a controller's sensory input and comprehension aids in the safe outcome or recovery from an event. Examples of sensory acts include missed pilot readbacks or misreading a datablock. The Sensory Act factors are as follows:

Auditory Perception

A controller's perception of auditory information differs from the actual auditory information. [Se01]

Visual Perception

A controller's perception of visual information differs from the actual visual information. [Se02]

Temporal Perception

A controller misinterprets or fails to accurately predict the timing of an event or object. [Se03]

Decision Acts

If an adverse sensory act does not occur, the controller has all the sensory information needed to make any decisions. For adverse decision acts, the controller or operator has adequate sensory information, and a mistake or error occurs in the development of a plan of action. Adverse decision acts occur when a controller's behaviors or actions proceed as intended yet the chosen plan proves inadequate to achieve the desired end-state and results in an unsafe situation. Positive decision acts occur when a controller's development of a plan of action aids in the safe outcome and recovery from an event. Examples of decision acts include a controller reacting incorrectly to a conflict alert or choosing to answer a hand-off line when a control instruction is time-critical to ensure separation. The Decision Act factors are as follows:

Alert Comprehension

An alert is perceived and understood by the controller but is dismissed and reacted to incorrectly. [De01]

Knowledge/Planning

A controller's knowledge or situation awareness is insufficient leading to an inadequate plan, decision, or choice. [De02]

Prioritization

A controller does not properly organize or conduct the tasks needed to manage an immediate situation. [De03]

Tool/Equipment Use

A controller selects the improper tool or equipment for a task or uses the tool or equipment inadequately. [De04]

Execution Acts

If an adverse sensory or decision act does not occur, the controller has all the sensory information needed and has correctly developed a plan of action. For adverse execution acts, the controller has adequate sensory information and has developed a correct plan, but an error occurs in the performance or execution of the plan. An adverse execution act is when a controller's execution of routine, highly practiced tasks related to procedures, training, or proficiency results in an unsafe situation. Positive execution acts occur when a controller's execution of tasks aids in the safe outcome or recovery from an event. Examples of execution acts include a failure to use positive control and misspeaking information on a handoff line. The Execution Act factors are as follows:

Controller Technique

A controller performs a task or job with an inadequate technique or uses an inadequate sequence. [Ex01]

Attention

A controller has a failure of attention to a task or a lapse in long-term, short-term, or prospective memory. [Ex02]

Communication

A controller has inadequate communication with other actors or selects the inadequate mode of communication. [Ex03]

Inadvertent Operation

A controller's movements inadvertently activate or deactivate equipment when there is no intent to operate the device. [Ex04]

Willful Violations

Willful violations occur when the controller is knowledgeable about an important rule and purposely chooses to violate it.

Willful Violations

The actions of the operator represent a willful and knowing disregard for the rules, regulations, procedures, or policies. Willful Violations are deliberate. [V01]

Situation Induced Violation

The actions of the operator represent a willful and knowing deviating from rules, regulations, procedures, or policies. However, an uncontrollable situation forces the operator to violate rules or procedures in order to achieve a safe outcome or prevent a more serious safety event. [V02]

Operator Acts Examples

Take a look at the following examples for factors at the Operator Act Tier:

- *"We had two aircraft entering a refueling track. The R-side asked SPORT45 to advise when you have MARSA. After a pause I heard SPORT45 say 'we will advise MARSA', but the R-side heard 'we advise MARSA'. The R-side vectored the fighters and when they were about 3 miles apart at the same altitude SPORT45 advised they 'were accepting MARSA'"*

  Other acts occurred here such as the D-side not speaking up, but the primary act was the R-side mishearing SPORT45, which is an Auditory Perception act. [Se01]

- *"The two aircraft were initially about 30-40 miles apart when I descended the first one. In normal cases this [is] too close for me to descend an aircraft. I did not fully analyze the traffic situation and therefore missed the second aircraft as potential traffic."*

  Because the controller 'knew better' but still descended the aircraft, this would be a Knowledge/Planning Decision act. The controller did not intend to create a safety situation, but simply made a poor choice. [De02]

- *"The aircraft at FL230 was given a descent to FL190 to stay above crossing traffic descending through 180. There was additional traffic directly below the first aircraft that was not seen until he advised that he had traffic at 12 o'clock."*

  Because the controller forgot about the traffic at FL220, this is an Attention Act. [Ex02]

- *"I saw the conflict alert go off and I turned the wrong aircraft. By the time I realized my mistake and corrected it, it was too late [and] minimum separation had been lost."*

  The controller misinterpreted the conflict alert, which is an Alert Comprehension. [De01]

- *"After issuing the handoff to the next sector, I noticed that I had entered the wrong altitude in the data block. I took the handoff back, amended the altitude, and re-flashed the handoff. I didn't know it had failed until the next sector alerted me."*

  The controller entering the wrong altitude was an Inadvertent Operation. The controller amended the altitude in the datablock and re-flashed the aircraft for transfer, but should have called the next sector to coordinate the action. However, the controller did not fully monitor the handoff. This routine action of flashing an aircraft was not executed as planned, which is classified as Controller Technique. [Ex04 and Ex01]

- *"I told SWA123 to turn 30 left with no response. I reissued the clearance and he turned, but too late to avoid a loss of separation. After listening to the tape, I realized I accidentally called him AWE123 the first time."*

  The controller misspoke the call sign of the aircraft, which is best classified as Communication Act. [Ex03]

- *"I issued 'present heading' to UAL123 to keep the aircraft from turning in to additional traffic I had taken a handoff on that was climbing through their altitude East of their position. After doing this, I moved on to other things and forgot about it until I realized I was entering the Center's airspace… I should have followed through with a point-out to [other sector] right away as taking UAL123 off course to the southwest gets in to their airspace very quickly at that altitude."*

  This is another case that is a little tricky, but ultimately comes down to a Prioritization. The controller chose to move on to other tasks instead of making sure the point out was accomplished in a timely manner. [De03]

- *"I was sitting across the room at a sector with only two airplanes. The supervisor wasn't in the area and there was no one else available, so I slid my chair across the room to help…"*

  The controller knowingly left his sector to help another controller without supervisor approval or an adequate briefing. However the controller violated the rules to help prevent a situation that was becoming overwhelming and unsafe, which is a Situation-Induced Violation. [V02]

Now that you have reviewed the most common types of operator act factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Operator Acts

Review the de-identified sample narratives below. Determine if the factor being described is a sensory act, decision act, execution act, or violation. Then determine which AirTracs factor from the operator act tier is being described. The scenarios below will be decision acts, execution acts, or willful violations. For this exercise reference the tables below:

Possible Decision Acts are:		
Alert Comprehension	Reacting to an alert with an ineffective action	De01
Knowledge/Planning	Arriving at an ineffective solution to a conflict	De02
Prioritization	Completing a less critical task instead of resolving a conflict	De03
Tools/Equipment	Improper or ineffective use of available resources	De04
Possible Execution Acts are:		
Controller Technique	Not using positive control or similar errors	Ex01
Attention/Memory	Forgetting about traffic or a traffic situation	Ex02
Communication	Failure to communicate correct and/or complete information	Ex03
Inadvertent Operation	Accidentally inputting incorrect information	Ex04
Possible Violations are:		
Willful Violation	Willful and knowing disregard for the rules	V01
Situation Induced Violation	Willful violation to achieve a safe outcome or prevent a more serious safety event	V02

1. *"AAL was climbing westbound. When he was through FL340 I asked him how soon it would take him to reach FL380 as I had crossing traffic, a point out at FL370. He said 3-4 minutes and the conflict was 5 minutes away so I decided to monitor the situation. When he was through 360 I told the AAL to maintain 1000 feet per minute or better. At 370 he said he couldn't maintain that climb rate anymore. I gave him a 50° turn but it was too late."*
2. *"The UAL was told to descend now to cross HFACS at FL240. ASQ an arrival to an airport a little farther away and 4000' above the UAL, was given discretion to cross HFACS at FL270. UAL descended slowly and ASQ descended rapidly resulting in a loss of separation…. I should have waited until UAL left FL270 before descending ASQ."*
3. *"ACA was a northbound overflight. I initiated the handoff to the next sector, but inadvertently [typed] 29 instead of 59. Another center called on the shout line to coordinate something involving a few different aircraft. After the conversation ended I realized ACA was 2 minutes into the next sector's airspace without a handoff."*
4. *"I handed JBU to the high altitude sector. They used automated information transfer procedures and typed in FL340. I climbed the JBU to FL360 thinking it was fl340 for some reason. I also missed the readback of FL360. Separation was lost shortly thereafter."*

5. *"I gave a new route to the business jet and descended him to FL350, missing the FLG traffic at FL360."*
6. *"AWI was climbing slowly and looked like he might need a point out to Sector XX. A Bonanza called looking to pick up his IFR clearance. I was distracted looking for his flight plan on URET when conflict alert activated between the AWI and traffic in Sector XX's airspace."*
7. *"I was very busy but the break bay was empty. A supervisor who was not certified on the sector plugged in to the D-side to assist."*
8. *"There were several aircraft in the holding pattern and my L-side was having trouble keeping the datablocks separated. When Conflict Alert activated he accidentally put another datablock in the mix. He quickly moved it but not before we realized we had assigned two aircraft the same altitude and separation was lost.*
9. *"A few minutes later, conflict alert went off with the JIA and the COM. I was complacent in recognizing this, as conflict alert goes off with around 50% of aircraft in the particular area. By the time I realized it was a legitimate conflict, I couldn't prevent a loss of separation."*
10. *"NKS was overtaking the Hawker by 80 knots. There were 25 miles from XYZ where their routes would diverge so I didn't think I needed to do anything and went on to other business. Conflict alert activated just as the Hawker was approaching XYZ and separation was lost before I could take further action."*

AirTracs Practice Quiz Answers: Operator Acts

1. Telling AAL to maintain 1000 fpm or better in the climb is not in the 7110.65, but that is not enough to classify it as a Willful Violation. The controller's motivations were not misplaced. Because the controller never issued a clearance to ensure positive control, this would be classified as Controller Technique. [Ex01]
2. This is a violation of the 7110.65, issuing an altitude to an aircraft that another aircraft less than five miles away has not been observed leaving [5-5-5b]. However, this narrative is not a blatant disregard of the rules. The controller later acknowledged that he used a shortcut that typically works when he should not have used the shortcut. This would be classified as Knowledge/Planning. [De02]
3. The controller accidentally typing the wrong number is an Inadvertent Operation. [Ex04]
4. Though this initially looks like another possible Inadvertent Operation act due to the misspoken altitude, the misspoken altitude combined with the missed readback fits much better as a Communication Act. [Ex03]
5. The controller forgot about the traffic at FL360. This is an Attention Act. [Ex02]
6. The point out should have been a higher priority than the flight plan. The controller mis-prioritized the flight plan over the point out. This is a Prioritization. [De03]
7. This is a Willful Violation by the supervisor. [V01]
8. The controller was did not use the equipment correctly. This is best described as a Tool/Equipment Use. [De04]
9. Due to alerting biases, the controller did not fully comprehend the conflict alert between the two aircraft, which is Alert Comprehension. [De01]
10. This is another example of not using positive control and is a Controller Technique. [Ex01]

Now that you've completed this warm-up drill, you can view the accompanying PowerPoint Quiz *AirTracs Operator Acts Quiz*.

OPERATOR CONTEXT FACTORS

This portion of the tutorial will focus on the first latent factor tier – Operator Context. Operator Context factors are those factors in a safety event that are preconditions for the operator actions. Operator Context is divided into controller workspace, NAS interactions, or controller readiness.

Figure 9: Operator Context

The Operator Context tier is the largest of the AirTracs tiers. Therefore, the Operator Context factors will be organized and presented by the Operator Context group in the following sections.

CONTROLLER WORKSPACE

Controller workspace may be the most straightforward of all the AirTracs categories. These factors describe the immediate workspace conditions that impact the controller. Controller workspace is classified as either physical environment or technological environment.

Figure 10: Controller Workspace

Physical Environment Factors

Physical Environment factors refer to the operational and ambient environment of the controller's immediate workspace.

Workstation / Work Area

A controller's workstation's design, position, housekeeping, or other work area aspects impacting controller performance. [PE01]

Lighting

A controller's workspace illumination or glare within the workspace impacting controller performance. [PE02]

Noise Interference

Any outside noise, sound, or sidebar conversation impacting controller performance. These noises may or may not be work-related. [PE03]

Vision Restricted

Weather, haze, darkness, environmental objects, tower window conditions, or tower/airport design restricts the vision of the controller impacting controller performance. [PE04]

Technological Environment Factors

Technological Environment refers to workspace automation factors and includes a variety of design and automation issues, including the design of equipment and controls, display/interface characteristics, checklist layouts, task factors and automation.

Communication Equipment

A controller's communication equipment (e.g., radio) impacting controller performance. [TE01]

Display / Interface

ATC software display or equipment interface impacting controller performance. While these issues may technically be software related, they manifest themselves to the reporter on the Radar display, ASDE-X, ARTS, URET, etc. [TE02]

Software / Automation

ATC software or automation performance or lack of performance impacting controller performance. [TE03]

Warnings / Alerts

Automated warnings or alarm (e.g., conflict alert, MSAW) performance or lack of performance impacting controller performance. This factor also includes nuisance alerts and failures to activate. [TE04]

Data Block

Information in the data block, lack of information in the data block, or display of the data block impacting controller performance. This factor also includes the data block obscuring or overlapping vital information from controller's view. [TE05]

Flight Progress Strips

Information in the flight progress strip, lack of information in the flight progress strip, or display of the flight progress strip impacting controller performance. This factor includes both paper flight progress strips and electronic flight strip facsimiles, such as URET. [TE06]

Field Equipment

Performance or lack of performance of technical operations equipment in the field, such as VORs, Radar, or an ILS, impact controller performance. [TE07]

Controller Workspace Examples

Take a look at the following examples for factors in the Controller Workspace group:

- *"I called Sector XX for a point out on my air carrier climbing to FL240. The frequency in use had excessive static levels. I did not hear the other controller reference traffic when he approved the point out."*

  Because the communications equipment is not working properly, this would be a Communication Equipment factor. [TE01]

- *"The aircraft that were in hold were having multiple bad Mode C hits. We were getting either bad altitudes or excessive-rate descents (3 digits with X following). During each bad hit I would verify altitudes with affected aircraft. Conflict alert was also going off because of the bad Mode C hits. I made at least a half dozen calls to verify altitudes, something that is a time consumer when the sector was as complex as it was at the time."*

  This is another technological issue. Although conflict alert is mentioned in the narrative, the automation did not display the Mode C properly, which led to conflict alert activating. This would be classified as Software / Automation. [TE03]

- *"…It appeared that the E170 had a stuck mic. Without success, I attempted to establish communications with the E170. I attempted to locate the VHF Emergency frequency on the control panel, but was not able to locate it."*

  The layout of the controller's workstation was impacting the controller's ability to find the frequency. The inadequate workstation would be classified as a Workstation / Work Area factor. [PE01] (There are other possible issues here as well including the controller being unfamiliar with his communication equipment, but those should be classified with a different set of factors.)

- *"Air Carrier XXX called for taxi and I thought he said Air Carrier XXX something, when I looked at my strips I had Air Carrier YYY so I taxied him out to the runway. A couple of minutes later an aircraft that departed tagged up as Air Carrier YYY and the Local Controller said that he/she had called him Air Carrier XXX because that is what strip indicated and the pilot hadn't corrected her, but it was apparently Air Carrier YYY with Air Carrier XXX's strip…On the strip the call signs looked identical."*

  The way the call signs were printed on the flight progress strips caused confusion for the controller. This should be classified as a Flight Progress Strip factor. [TE06]

- *"At that point I was distracted by a discussion going on at Clearance Delivery/Flight Data/Ground Control. Training had just ended at Local Control due to staffing [and] position relief was going on at Clearance Delivery/Flight Data/Ground Control."*

  The discussion and training created a Noise Interference factor that distracted the controller from his task. [PE03]

- *"The ASDE is a digital, estimated approximation of the aircraft location. There are computer icons for aircraft. Many times these icons face 180 degrees opposite of the direction the aircraft actually is. The ASDE is not totally reliable information. The same icons are used for this B737 as would be used for a C152, yet they are vastly different aircraft."*

  The controller reported several issues with the way information is presented to the controller on the ASDE display. This is an example of Display / Interface factor. [TE02]

- *"I failed to notice the MD80 descending below his assigned altitude of 6,000. I cleared the other air carrier for the approach and returned my attention to the MD80. It was then that I noticed the MD80 at 3,500 in a 4,400 MVA area…Low Altitude Alert never triggered for this event. I would suggest finding out why."*

  The low altitude alerts did not activate, which should be classified as a Warnings / Alerts factor. [TE04]

- *"In this case, a better view of the approach end of Runway XXL and XXR would have helped me determine that the Cherokee was not only overshooting final, but also landing on the runway. Our Tower is among the shortest I have ever seen in the country, which puts us at a disadvantage for determining an aircraft's position on final. The size difference between the two aircraft can be misleading to be able to give a 100% determination for an aircraft's position"*

  The low tower height created a limited field of view for the tower controller. This is a case of a Vision Restricted factor. [PE04]

- *"I did not notice the limited data block of the P180 as it was covered up by the tag on the B737."*

  Overlapping data blocks is a Data Block factor. [TE05]

Now that you have reviewed the most common types of controller workspace factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

Tip for Classification

Remember that, like other factors, an operator condition or context does not necessarily have to have a direct impact on the outcome to be classified as a factor. The factor can be classified as 'observed' if no association is apparent or as a 'positive' if the factor helped to prevent the event from become more severe.

AirTracs Practice Quiz: Controller Workspace

Review the de-identified sample narratives below. Determine if the factor being described is a physical environment or technological environment. Then determine which AirTracs factor from the controller workspace is being described. For this exercise reference the tables below:

Possible Physical Environment Factors are:		
Workstation / Work Area	Factors related to the controller's 'duty station'	PE01
Lighting	Workspace illumination or glare	PE02
Noise Interference	Any external sound or conversation around the workspace	PE03
Vision Restricted	Weather, darkness, or obstructions impacting the field of view	PE04
Possible Technological Environment Factors are:		
Communication Equipment	Controller's communication equipment	TE01
Display/Interface	Graphic traffic and information displays	TE02
Software/Automation	Performance of ATC software / automation	TE03
Warnings/Alerts	CA, MSAW or other controller alerting systems	TE04
Data Block	Information in or display of the datablock	TE05
Flight Progress Strips	Information in or display of the flight progress strips	TE06
Field Equipment	Remote, off-site equipment	TE07

1. *"During investigation and review of ground radar replay on the ASDE-X it clearly showed that the airport operations data tag had Ops X tagged on the display, however as the vehicle began its drive towards the runway the data tag jumped to another vehicle. This left the operations vehicle as only a small blue primary target on the ground radar. That small blue target moved ever so slowly down the runway and eventually Aircraft X saw the vehicle and reported its position."*
2. *"The other Center could not use the automated hand [off], so they called to perform a manual hand off. I had the flight information in URET but no ID. I took RADAR on the aircraft. Center shipped me the aircraft right away. The aircraft was just outside my boundary maybe 10-15 miles. I tried to use the template feature in the URET to put in the flight plan but was unable to due to duplicate flight ID. So then I attempted to add an Alpha to the end of the call sign, but it was a 4-digit Air Carrier. I didn't realize right away that I had too many alphanumeric (8 instead of the maximum 7) and tried it multiple times both in URET and in HOST while also talking to aircraft and managing land line calls. I felt I was spending too much 'heads down' time working on this issue and now the aircraft was about 30 miles into my airspace."*
3. *"I did not have a radar handoff on the Saab and as I questioned his call sign for accuracy the second time to locate the aircraft he added his position and altitude. Due to data-block overlap, this was the first opportunity I had to notice the UN-tracked limited datablock in the*

vicinity of the ASQ. Realizing that the UN-tracked data block was converging with the climbing ASQ I issued a right turn to the Saab and a left turn to the ASQ in hopes of averting a collision (separation was already lost). The Saab questioned the turn and I called the traffic at a mile to which he reported the aircraft in sight and completed my turn."

4. *"During this time, the supervisor began a conversation with the R side trainer at next sector about his recent vacation to the Caribbean. My trainee was seated directly in between the sup and the other trainer with his open ear facing the supervisor. When the traffic call was made to the SWA, the pilot reported that he was responding to a TCAS RA. My trainee did not hear this and switched the aircraft to the next sector who now had the handoff. When asked why he switched an aircraft who was still responding to an RA, my trainee replied that she had not heard the aircraft's report because of the loud conversation that was occurring."*
5. *"The sector in Approach that my sector hands arrivals off to at 10000 feet lost the use of their … frequencies, and landline."*
6. *"When Approach called to make the handoff the aircraft was well outside of their airspace and flying further away, they were concerned about losing radar coverage. Our radar coverage is even worse below 4000' throughout almost all of our airspace."*
7. *"Speeds on both aircraft at the time of clearance delivery were similar and the CPC in training commented that the CRJ7 should stay in front of the Citation. Distracted with other duties, both the CPC in training and the trainer didn't notice that the CRJ7 had slowed significantly until conflict alert activated. The CPC in training slowed the citation and accelerated the CRJ7. He then asked for and received an altitude report from the CRJ establishing vertical separation.''*
8. *"I told the Sweeper to hold short of [runway] XX/YY and I saw him turn around and he read back the hold short instructions. Due to the angle from the Tower I could not tell if he crossed the hold short line."*
9. *"I was trying to monitor everything my trainee was doing to be sure he/she was making the correct decisions and control instructions when I did not notice one of the aircraft tags had fallen off the scope… I am not sure why the aircraft's tag fell off the scope. It should have either gone into the coast list or been [in] a sleep mode still displayed on the scope. Being that from where it is customary for OJTI's to sit it is difficult to see the strips the trainee is working, I would recommend a better way or place to display the strips so it was easier for an OJTI to monitor the strips in the bay without getting up and walking around the Trainee."*
10. *"The lighting in the TRACON was so low that I could not see to reference my maps."*

AirTracs Practice Quiz Answers: Controller Workspace

1. While there is a good chance that something in the software / automation caused the target to jump to the wrong vehicle, the narrative presented this as something that occurred on the display, which means this would be classified as Display / Interface. [TE02]
2. This controller had a difficult time trying to get the automation and software to accept the correct flight plan. This would be classified as a Software / Automation factor. [TE03]
3. This is another case where there was most likely an underlying automation / software issue. However, the narrator described the data blocks as the main issue. [TE05]
4. The conversation about the Caribbean vacation was a Noise Interference issue. [PE03]
5. The controller lost the ability to use the communications equipment. [TE01]
6. Though there was no equipment failure in this case, the limited quality of the radar below 4000' is classified as a Field Equipment factor. [TE07]
7. There are several other factors in this narrative that would be classified elsewhere. When examining the role of the controller workspace, the Conflict Alert helped alert the controller of the situation and helped to prevent a loss of separation. This is a positive factor credited to Warning / Alerts. [TE04]
8. The controller's view was obstructed from the tower, which would be classified as Vision Restricted. [PE04]
9. The OJTI did not feel like there was anywhere he could position himself to monitor the trainee and the strips simultaneously indicating an inadequate Workstation / Work Area layout. [PE01]
10. The controller's physical work environment had inadequate Lighting. [PE02]

NAS Interactions

NAS Interactions factors describe the impacts of the conditions of the NAS, the airspace environment of the aircraft / airport, and the action of the flight deck on the controller's performance. NAS Interaction factors also describe the interactions a controller has with other actors (e.g., other controllers, flight crew, etc.) within the NAS. NAS Interactions are classified as airport conditions, airspace conditions, aircraft actions, and communication.

Figure 11: NAS Interactions

Airport Conditions Factors

Airport Conditions refer to the environmental and design conditions of the airport involved in the event.

Combined Positions

ATC tower positions are combined or separated impacting controller performance. [APC01]

Ground Vehicle Traffic

Ground vehicles or other similar vehicular traffic impacting performance. [APC02]

Aircraft Traffic

Movement area or surrounding airport airspace traffic level and/or complexity impacting performance. [APC03]

Airport Weather

Airport visibility, wind conditions, or other weather conditions impacting performance. [APC04]

a. Visibility / IMC [APC04a]
b. Wind [APC04b]
c. Other Airport Weather [APC04c]

Signage / Lighting / Ground Markings

Airport signage, lighting conditions, or ground markings impacting performance. [APC05]

Construction

Airport construction impacting performance. [APC06]

Layout/Design

Airport layout or design is impacting performance. Note that the placement of the tower cab and its impact of controller line of sight are classified under Physical Environment. [APC07]

Runway Conditions

Runway conditions, such as inactive runway status or FOD, impacting performance. [APC08]

Airspace Conditions Factors

Airspace Conditions refer to the physical or design conditions of the airspace involved in the event.

Combined Sectors

Airspace sectors are combined or not combined impacting controller performance. [ASC01]

Combined Positions

En route or TRACON positions are combined or not combined impacting controller performance. [ASC02]

Sector Traffic

Airspace sector traffic impacts controller performance due to traffic level, complexity, or other traffic characteristics. [ASC03]

a. Traffic Level [ASC03a]
b. Traffic Complexity [ASC03b]
c. VFR Traffic [ASC03c]
d. Restricted Airspace [ASC03d]

Tip for Classification

Traffic Level refers to the number of aircraft in the sector, while Traffic Complexity refers to the difficulty of working the existing traffic. A controller can be working numerous overflights with limited distractions and stress, or a controller can be completely under water with a small number of transitioning airplanes.

Sector Weather / Turbulence

Sector weather or turbulence impacting performance. [ASC04]

Sector Design

Sector design characteristics (e.g., boundaries, sector shape) or sector route design impacting performance. [ASC05]

Airport and Airspace Conditions Examples

Take a look at the following examples for factors in both Airport Conditions and Airspace Conditions:

– *"I was working LC with all positions combined in the tower, which is a regular occurrence for Saturday level traffic."*

  This is a clear case of Airport Conditions – Combined Positions. Note that since the reporter stated this is a regular occurrence, it is implied that this did not necessarily contribute to, or cause the incident. This will most likely be 'Observed' as Combined Positions. [APC01]

- *"After Mobile Alpha finished working on the ILS, he requested to proceed to taxiway Juliet (in order to exit the airfield) via taxiway Delta. My trainee gave the clearance, adding hold short of Rwy XX. Mobile Alpha acknowledged. We watched the C152 aircraft coming down short final for Rwy XX touch and go and then during a runway scan we observed Mobile neglect to stop at the runway hold short line at taxiway Delta for Rwy XX and was more than halfway across the runway."*

  This time Ground Vehicle Traffic contributed to the incident. (This is Contributory – the incident would not have occurred without the ground vehicle). [APC02]

- *"I was the CIC on duty, monitoring the Local Controller. The Local Controller had many aircraft on their frequency, and had just cleared the BE24 into right closed traffic, Runway XX. As the BE24 was turning downwind, the Local Controller cleared the CX-4 for takeoff from Runway XX, and approved them for right closed traffic. As CX-4 lifted off the runway, they began an early right turn, directly towards the BE24. I advised the Local Controller by saying 'Hey, look!' while pointing at the situation developing."*

  There are a lot contributing factors in this scenario, but for Airport Conditions, the key phrase is 'The Local Controller had many aircraft on their frequency.' This is classified as Airport Traffic because of the high level of traffic. [APC03]

- *"The final approach was directly into a setting sun that compromised forward visibility [to the pilot] but not to the extent that it would compromise a good landing on a clear runway. The small orange cones and 6 inch high plastic barriers were totally invisible with the orange sun set behind them."*

  This is a visibility issue caused by the meteorological conditions/weather. The factor is Visibility / IMC. [APC04a]

- *"Multiple aircraft in pattern for one runway due to wind 27014G22"*

  This portion of the narrative described is Airport Weather, specifically Wind. [APC04b]

- *"I then scanned to make sure the Marquetee was taxing as instructed, and that's when I heard the Local controller say "hey, hey!" pointing at the Cessna, who was crossing the hold bars and taxing onto runway XX without a clearance to do so…Recommendation: The Airport has a lack of signage. There have been many complaints regarding this. Better signage on the taxiways."*

  When examining the Airport Conditions, the narrative described how Airport Signage / Lighting / Markings impacted the safety event. [APC05]

- *"Construction was in progress on Taxiway Alpha and Bravo (two frequently used routes). All aircraft needed to cross Runway YYL had to use Runway XX or Taxiway Charlie."*

  This portion of a narrative described how construction can impact operations. [APC07]

- *"The Cab Coordinator noticed the C172 started moving forward again and encroaching on Runway XX so he told me to 'send that guy around.' I instructed the Decathlon to go around when he was on approximately a 1/4 mile final...Since it is not possible to taxi from the west ramp to Runway YY without crossing Runway XX. Runway incursions are far too frequent."*

  The narrator described how the taxiway and runway designs impacted runway incursions, which is classified as a factor of Airport Layout/Design. [APC07]

- *"I was conducting a skill check on Ground Control. Weather was VFR. Normal morning traffic with snow removal operations in progress."*

  Because snow removal was in progress, there was snow on the runways, which is classified as Runway Conditions. [APC08]

- *"I was working sectors XX, YY, and ZZ combined up."*

  This is a clear case of Airspace Conditions – Combined Sectors. [ASC01]

- *"I was working moderately complex traffic alone and either missed a bad altitude or the pilot reported it wrong. If I would have had help such as a D side, chances are the mistake would have been caught. A D-side would have freed me up to pay more attention to check-ins or provided an extra set of ears."*

  This narrative described how Airspace Conditions – Combined Positions impact controller performance. [ASC02]

- *"15 mile in trail to satellite airports just expired. Sector became overloaded with volume to these airports with a different mix of types with no real spacing entering the sector. I turned the EJA as well as several other aircraft to provide the flow over the next fix. The EJA was also descended and slowed. The vector that the EJA was on did not clear EGF. Aircraft lost separation."*

  The reason the sector became overloaded would be found elsewhere in the narrative and classified as well, but for Airspace Conditions the sector was overloaded due to volume, which is classified as a Traffic Level factor. [ASC03a].

- *"Weather was preventing a normal flow into the arrival airport, and I was receiving 2 feeds…Working the normal traffic for sector plus deviating metro arrivals. Had to step aircraft up and down to get them through my sector."*

  The narrator described traffic that was more complex than the normal traffic because of the additional flow of arrivals. This would be classified as Traffic Complexity. [ASC03b]

- *"N#####B was receiving VFR advisories from me, level at 10,500. When aircraft got about 10nm NW of the airport, the track coasted and then jumped onto another target about 10 miles away…I had the pilot ident, but I was having trouble seeing him due to numerous limited data blocks in the area. I noticed a 0202 limited datablock…I was afraid N#####B was going to be traffic for the 0202 code. Shortly thereafter, he said he saw an aircraft pass 400 feet below him, and sounded very concerned about it. It was then I realized N#####A was squawking the same beacon code as the VFR 0202 parachute aircraft. That is why the datablock jumped."*

  Although there are many factors in play, the Airspace Conditions factor impacting the event is the VFR Traffic. [ASC03c]

- *"I gave the PDT direct upon checking on the frequency. I did not consider the restricted area's status. As the PDT approached the restricted area, which I thought was active 040 and below, I reviewed the SIA and realized it was actually FL240 and below. I immediately issued a left turn to a heading of 360 degrees. This clearance was issued with insufficient time for the aircraft to remain clear of the airspace. Once the aircraft was clear of the restricted area, I re-cleared them direct."*

  When examining the Airspace Conditions, the controller did not incorporate the Restricted Airspace into his decision-making. [ASC03d]

- *"I climbed him from FL230 to FL340. He crossed the boundary climbing from FL245 to FL340. I didn't realize how slow he was climbing and therefore didn't point him out to the sector, which owns FL260 and below. I immediately called them to verify that he was watching the aircraft and he assured me that he was. … Be cognizant of the warm air temperatures and how they will effect aircraft performance."*

  Once more, there are other things being described in the narrative. The Airspace Conditions being described were the warm temperatures (Sector Weather / Turbulence) that led to the slow climb. [ASC04]

- *"When the previous sector vectors aircraft off of the Jet Route and gives them a routing direct a fix or intersection along the route of flight these aircraft enter my sector and then almost immediately enter the shelf the departure sector below me owns."*

  This narrative describes how the sector shelf design and route design made controlling traffic difficult. [ASC05]

Now that you have reviewed the most common types of airport and airspace conditions factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Airport and Airspace Conditions

Review the de-identified sample narratives below. Determine if the factor being described is an airport or airspace conditions. Then determine which AirTracs factor from the airport or airspace conditions is being described. For this exercise, reference the tables below:

Possible Airport Conditions are:		
Combined Positions	Tower controller is working more than one position	APC01
Ground Vehicle Traffic	Airport operations, Emergency vehicles, etc.	APC02
Airport Traffic	Airport traffic volume and/or complexity	APC03
Airport Weather	Weather conditions impact the operation A. Visibility / IMC B. Wind C. Other	APC04a APC04b APC04c
Signage / Lighting / Ground Markings	Airport infrastructure, signage, markings, or lighting	APC05
Construction	Airport construction	APC06
Layout/Design	Runway, taxiway, or other design	APC07
Runway Conditions	Ice, FOD, closed runways, etc.	APC08
Possible Airspace Conditions are:		
Combined Sectors	Sectors combination	ASC01
Combined Position	No D-side or even no L-side	ASC02
Sector Traffic	Airspace sector traffic A. Traffic Level (quantity) B. Traffic Complexity (quality) C. VFR Traffic D. Restricted Airspaces	ASC03a ASC03b ASC03c ASC03d
Sector Weather / Turbulence	Thunderstorms, Icing, Chop, Wind, Heat (causing slow climbs), etc.	ASC04
Sector Design	Shelves, boundary configurations, or other sector characteristics	ASC05

1. *"Aircraft inbound to RWY XX approximately 6 mile final. Airport Safety asked who I was in contact with regarding the 30 ft. crane west of the RWY threshold. I was not aware that I was supposed to be in contact with anyone regarding the crane. In fact, I did not understand why an unlit crane was in the approach [path] at night. Apparently, I was supposed to notify FAA engineering 15 minutes before the arrival of an IFR plane so that it could be lowered."*

2. *"It appeared the pilot had to force it down harder than desired…When the aircraft began turning left in his taxi it appeared to lose control and did a 720 degree turn before coming to a complete stop and advised that they broke their tail spring. I notified the supervisor of the aircraft condition. The aircraft was able to resume taxiing on to taxi-lane alpha and I gave Airport Operations permission to enter the runway for a FOD check. At this time I had 1 aircraft ready for departure, another taxiing to the runway, and a Challenger on final approach. Once operations reported the "spring in hand" and was off the runway I issued a landing clearance to Challenger ###A. When ###A was approximately 4 mile final airport operations called again requesting permission on the runway as the pilot had reported to them another spring potentially on the runway."*
3. *"I was working two sectors combined by myself, and the Air France had descended to cross the arrival fix at 120 in the south part of the sector. I had initiated the handoff and didn't realize I was handing off to the wrong sector at approach… a d-side might have helped out to help me watch my boundaries when I was working on traffic situations in other parts of the sector."*
4. *"The ATR-42 checked on to the frequency and I issued him a heading of 280 to get him away from arrival aircraft. There was a strong wind out of the north and the vector was not as expected...There was numerous distractions from the d-side position that diverted my attention from the event… This diverted my attention from items that needed to be looked at. When I noticed that the ATR-42 was drifting to the south, I tried to stop the UAL at 17,000 but it was too late and he was already through it."*
5. *"I was Local, Ground, and Flight Data all combined."*
6. *"The other thing I wanted to elaborate on, was with the MOA being active during this situation, and the Departure gate that was open had planes on headings to parallel that gate, which means they are all aimed for it. I can only imagine if they can't climb above the MOA or take a clearance to avoid it, we might have had a lot more violations with the MOA."*
7. *"I had multiple departures and told the aircraft to cross mid-field and enter left downwind runway XX. At the time the wind was coming from the south and varying from the west as well. We had multiple reports of wind shear as well as shifting winds, so while the experimental was over head I issued the most recent wind condition report."*
8. *"I was conducting OJTI on LC with a moderately low-hours trainee. This was the most complex situation he's seen yet, and it was by any measure quite complex for this airport. It developed much faster than the trainee was able to comprehend. Basically, he was about to go down the crapper and take me with him, and he didn't even know it."*

9. *"I climbed a non-RVSM aircraft to FL360 because I had potential traffic at FL380. Most aircraft in my sector were deviating for weather, including these two. I couldn't climb him any higher, so I PVD'ed him to sector that owned the shelf up to FL350 he was about to overfly, but I didn't have time to call them. At the time, I was changing a route that TMU requested, coordinating all the deviations and trying to accommodate all the pilots' requests, as well as coordinating the non-RVSM/IAFDOF/deviating citation I was handing to the next sector."*
10. *"The Cessna read back the instructions and looked like it was starting its turn onto Runway XX so I moved over to the IDS computer to go over the requirements for the next ATIS. I checked the MD88's position on the Clearance Delivery Tower Display Workstation (short final) and scanned the runway a final time. I didn't notice the aircraft at first because the lights were dim and I didn't expect it to be there, but the C172 was still on the runway about to pass taxiway Alpha."*
11. *"Air Carrier X was on the VOR/DME approach to Runway XXL followed on approach by an A320, conditions were very marginal for this approach with minimums published at 450 FT and numerous PIREP's of ceiling 300 FT with a scud layer of clouds. While this event took place numerous missed approaches were executed by the previous aircraft on approach."*
12. *"When the loss occurred The CPC had been there for 1:30 with very busy traffic the whole time. At the time this occurred there were 16 a/c in the sector, the sector has a MAP value of 16."*
13. *"The pilot taxied to the active runway (RWY XX) and was holding short on taxiway B3. He performed his run up then proceeded to taxi to the approach end of RWY XX, crossing the hold short line…I think this pilot deviation could be partially attributed to a very poor airport layout. The hold short line on B3 is approximately 800-1000 feet from the runway end. This can be very confusing for the pilots as it is a very uncommon situation."*
14. *"I was working combined sectors and had been providing advisories to a NASA aircraft doing VFR air work. A UAL Airbus was descending via a new star. I called traffic to both aircraft. The VFR A/C reported the UAL in sight at about the same time the UAL A/C told me they were responding to a TCAS RA. I looked for a manager to inform them but did not see one."*
15. *"The TBM was on short final RYXX cleared to land. As I was scanning the runway, I observed a white truck with a trailer at the approach end of RYXX approaching the hold short line. I asked the ground controller if he was talking to the vehicle he said he was and he was spraying in the safety area. I kept watching as the vehicle pulled onto the runway on the threshold. I sent the TBM around for vehicle on the runway."*
16. *"I do think the design of the sectors creates many opportunities for missed point-outs, between the shelf in the middle of the sector and the adjacent airspace configuration (when combined, adjacent to over 12 different sectors with various altitude stratum's"*

AirTracs Practice Quiz Answers: Airport and Airspace Conditions

1. Tall construction equipment created a hazard for low flying aircraft. [APC06]
2. In addition to Operator Acts factors, the controller described both Airspace Conditions – Combined Sectors and Combined Positions. [ASC02 & ASC01]
3. The pilot reported a spring on the runway resulting in FOD and Runway Conditions being a factor. [APC08]
4. The controller described an Operator Act factor related to being distracted by the D-side activities. For airspace conditions, the controller described how winds (Sector Weather / Turbulence) affected the course of the aircraft and contributed to a Loss of Separation. [ASC04]
5. This part of the narrative described Airport Conditions – Combined Positions. [APC01]
6. A Military Operating Area is classified as Restricted Airspace. [ASC03d]
7. This tower controller described how the winds at the airport (Airport Weather – Wind) impacted operations. [APC04b]
8. In addition to OJT occurring, the controller described the traffic as "by any measure quite complex for this airport." This would be classified as Airport Traffic. [APC03]
9. Between the non-RVSM traffic and the weather deviations, the sector traffic was complex. [ASC03b]
10. The controller described not being able to "notice the aircraft at first because the lights were dim." The lighting in the tower cab would be classified with an Airport Lighting factor. [APC05]
11. In addition to Airport Traffic complexity, the IMC Weather was impacting the airport and operations. [APC03 and APC04a]
12. The radar controller described the 'busy traffic' and how the sector traffic level was approaching the MAP value. This would be classified as Airspace Condition – Sector Traffic Level. [ASC03a]
13. The tower controller described how the position of the hold short bars on the taxiways can confuse pilots and impact operations. This factor would be classified as Airport Layout / Design. [APC07]
14. The controller described how an aircraft in the area was a VFR aircraft and impacting operations. The controller also described combined sectors. This would be classified as Sector Traffic – VFR Traffic and Airspace Conditions – Combined Sectors. [ASC03c and ASC01]
15. The controller described how the Ground Vehicle Traffic caused a runway incursion. Fortunately, the controller was closely monitoring the situation and was able to send the arrival aircraft around. [APC02]
16. The controller described how the Sector Design can impact point outs. [ASC05]

Aircraft Actions Factors

Aircraft Actions refer to the actions or inactions of the aircraft involved in the event that impact operations.

Deviation

A pilot deviates from standard procedures or ATC instructions. [AA01]

a. Procedures (FARs, AIM, STAR, Approach plate, etc.) [AA01a]
b. ATC Clearance [AA01b]

Unexpected Aircraft Performance

Aircraft performance is outside of normal expectations, but not enough to qualify as a deviation. [AA02]

Aircraft Equipment / System Operations

An aircraft's equipment or automation malfunctions (loss of transponder, RVSM capability, etc.). [AA03]

Responding to Abnormal Situation

An aircraft is experiencing an abnormal situation (e.g., emergency, minimum fuel). [AA04]

Go Around

An aircraft conducts a go around impacting operations. [AA05]

Flight Planning

A pilot's preparations or planning for a flight impacts operations. [AA06]

TCAS RA Response

A pilot receives a TCAS RA and must follow RA instructions. [AA07]

Communication Factors

Communication refers to the teamwork factors of coordination and communication involved with the preparation and execution of a plan that impact operations.

Controller-Cockpit Communication

Controller-to-flight crew communication is necessary for operations and impacts controller performance. [CC01]

a. **Readback/Hearback**: A controller does not hear or mishears a readback differing from the message the controller was trying to communicate. [CC01a]
b. **Phraseology/Call Sign**: Phraseology or call sign confusion impacts controller performance. [CC01b]
c. **Information/Clearance**: Communication about information or control instructions impact operations and controller performance. [CC01c]
d. **Frequency Congestion**: Blocked transmissions and/or an abundance of aircraft on the frequency impact operations and controller performance. [CC01d]
e. **Responsiveness**: Pilot is slow to acknowledge controller's transmission or does not acknowledge it at all. [CC01e]

Controller-Controller Communication

Controller-to-controller communication (verbal or written) is necessary for operations and impacts controller performance. [CC02]

a. **Position Relief Briefing:** The controller position relief briefing during transfer of responsibility impacts controller performance. [CC02a]
b. **Handoff/Point Out:** An aircraft handoff or point out between sectors impacts controller performance. [CC02b]
c. **Aircraft Information:** Coordination of aircraft information impacts controller performance. [CC02c]
d. **Phraseology:** Controller-controller phraseology. [CC02d]

Aircraft Actions and Communications Examples

Take a look at the following examples for factors in Aircraft Actions and Communications:

- *"The PA46 departed IFR via the SID with initials vectors to the VOR. The SID clearly states that aircraft will fly runway heading for radar vectors to initial fix. Observed aircraft off departure end turning left downwind towards initial fix and was not in communication with them."*

  The pilot did not fly the SID he had been issued. This is classified as a Deviation from Procedures. [AA01a]

- *"I cleared the EJA to land Rwy XX and told him to remain within 3 miles of the airport. The EJA continued towards neighboring Class B airspace. I told the EJA to turn southwest to exit Class B airspace, pilot acknowledged but continued towards the neighboring airport…I then told him to turn right west bound now. He turned back into our Class D airspace and landed. The neighboring controller advised they lost separation with 2 aircraft - one on final and one departure…Pilot called the tower after landing and said they had the wrong airport in sight."*

  The pilot had the wrong airport in sight causing the pilot to deviate from controller instructions. [AA01b]

- *"A CRJ and a Citation were departures off separate airports both routed over the same VOR. Speeds on both aircraft [were similar] and the CPC in training commented that the CRJ7 should stay in front of the Citation. Distracted with other duties, we didn't notice that the CRJ7 had slowed significantly until conflict alert activated. We slowed the Citation and accelerated the CRJ7. After the aircraft were no longer a factor, I asked the CRJ7 what the KIAS speed was before I assigned 310 and he read back that they were indicating 260KIAS which I did not expect a CRJ7 to operate at in a normal decent."*

  The controller expected the CRJ to climb out at a normal speed. The aircraft descended at a slower rate. This slower speed is classified as an Unexpected Aircraft Performance. [AA02]

- *"ASQ#### checked on stating he was having issues with his compass and would be deviating from the RNAV departure. ASQ#### had already compromised separation"*

  The compass issues would be classified as Aircraft Equipment / System Operation. [AA03]

- *"F18 climbing from FL410 to FL450. Told me he could not hold altitude. I re-cleared him to FL390. He descended through FL390 and kept descending without telling me. I asked him his altitude. He told me he couldn't maintain altitude. I asked him what he needed to descend to. He said FL250. He also lost all speed of the aircraft. Another aircraft was initially 10 miles behind him at 450 knots climbing up to FL430. The second aircraft was overtaking the first rapidly. I turned the aircraft 90 degrees to the right to try and keep 5-mile separation. They passed with about 4 miles of separation."*

  The military aircraft could not maintain altitude or normal speed, which is classified as a Responding to an Abnormal Situation. [AA04]

- *"Pilot reported going around due to wind shear."*

  This portion of the narrative is classified as a Go-Around. [AA05]

- *"Sequencing for multiple airports…was causing tunnel vision of the sector. Then, no notice hold for Airport A with about 7 Airport A flights on frequency. Set up holding pattern and was not aware that the Lifeguard's route had a shortcut that put him through holding pattern at FL370. When the traffic situation became imminent DAL responded to RA and climbed to FL380 to miss the Lifeguard."*

  While there are many factors in the narrative, the Aircraft Actions factor is the TCAS RA Response. [AA07]

- *"I was working an F16 departure. His Mode C never worked so I needed to constantly get an altitude verification. The F16 was level at FL260, which is the top of my airspace. I pointed out the F16 to sector XX…it was approved. I came off the line and climbed the F16 to FL270 and told him to report. I meant to say FL280. The F16 reported level at FL260 then said FL270. I thought he said FL280. I reported him level at FL280. I proceeded to switch him to the next sector. I was unaware he was at FL270 because his Mode C never worked while in my airspace. It wasn't until 5-7 minutes after that the next sector told me he was still at FL270.."*

  While there are many factors in the narrative, the Controller-Flight Deck Communication factor is related to the Readback/Hearback act for the altitude. [CC01a]

- *"As the GLEX continued descending to the airport, I started to call traffic to the C172. The Cesena reported the GLEX in sight. I told N##z to maintain visual separation from that traffic and unfortunately they only responded with their call sign. I used incorrect phraseology to apply visual separation."*

  Because the controller did not use proper phraseology to apply visual separation, this Controller-Flight Deck Communication factor is classified as Phraseology / Call Sign Error. [CC01b]

- *"Upon seeing a possible conflict with the Falcon, I turned the FDX 15 [degrees] right to go behind him…The Falcon overshot the Jet route and corrected to the left to re-intercept. I then noticed the initial vector for the FDX was not enough and issued an additional turn to the right. The transmission was blocked and had to be repeated. I then issued a turn of 40 [degrees] right to the vector. He replied questioning the vector making it necessary to reissue the instruction. With the blocked transmission and the questioning of the vector, neither turn happened in time."*

  Several factors played a role in this incident. The Controller-Flight Deck Communication issue is related to the pilot questioning the vector. The pilot's actions complicated the event. However, the controller could have prevented this possibility by complying with 7110.65 5-6-2b – advising the

reason for the vector at the time it was issued. Unclear communication by the controller created misunderstanding for the pilot, which is classified as an Information / Clearance factor. [CC01c]

- *"Weather was bad causing a significant increase in communications, deviations, reroutes and overall workload. I was working a northbound arrival at FL310 and had descended eastbound crossing traffic to FL290 from FL350. I became distracted by multiple landline calls as well as requests for deviation and did not notice the slow decent rate of the eastbound A/C. I was alerted to the developing situation by the flashing. I was delayed by several seconds because the frequency was being used by a pilot."*

  The Controller-Flight Deck Communication issue described in the narrative is related to the controller being delayed from issuing a clearance due to Frequency Congestion. [CC01d]

- *"The EJA was cleared for the Visual Approach and frequency changed to tower. Tower departed the LXJ as a normal departure. The EJA did not respond on tower frequency despite numerous attempts including 121.5. He followed the ground track depicted on the approach and descended into the departure corridor in direct conflict with the LXJ. Tower issued traffic repeatedly to LXJ but the pilot never saw the other aircraft."*

  The pilot of the EJA was issued a change of frequency. The tower controller reached out to the pilot of the EJA, but the pilot's lack of Responsiveness was a factor. [CC01e]

- *"I was regrettably somewhat unprofessional during the briefing, as traffic was light and there were distractions in the room around me. After I accepted the position, I worked traffic without incident for approximately 6-8 minutes. I had not completely reviewed the information in my URET, but was in the process of doing so when an aircraft transmitted, "Are we still supposed to be with you?" …I asked him to repeat his call sign…I discovered that I had the handoff…I immediately ranged out and saw the data tag in the next sector's airspace."*

  The safety event narrative described many factors. The Controller-Controller Communications issue is related to the Position Relief Briefing. [CC02a]

- *"Aircraft were routinely [deviating] into adjacent airspace…the AWE deviated well into the next Center's airspace and could not return to the Arrival. My D-side and Tracker were unable to get the neighboring center sectors to answer landlines for coordination/point outs. The situation was unsafe as the AWE was more than 20 miles outside of my airspace. I advised AWE to squawk emergency. Eventually my assistants were able to effect coordination and Approach took radar."*

  This incident resulted in an airspace violation. The controller was unable to make a point out because the adjacent Center was not answering their lines. This is classified as a Controller-Controller Communications – Handoff / Point Out factor. [CC02b]

- *"The supervisor told me we were gonna split the sectors out. I then started the process to split out. During the process for splitting these sectors out I had an aircraft on a bad route. I asked the supervisor for a better route. While trying to give the sector XX controller the briefing to take the sector, I had multiple planes checking on a call from another sector about a bad route and had my supervisor asking questions about the airplane I had on a bad route. During this I received a call from the adjacent Center and I released higher on an aircraft at FL360 to FL380. I failed to tell sector XX about releasing higher... When the controller took my frequencies and assumed sector XX his first clearance was to descend a guy from FL390 to FL370. This put him in conflict with the aircraft I released for higher."*

  While there are many factors being described, the Controller-Controller Communication issue relates to the releasing of the aircraft to a higher altitude. The controller failed to relay the Aircraft Information (altitude) to the controller splitting the sector. [CC02c]

- *"I noticed the BE10 was turning back toward the VOR and updated the route line. He would be cutting into Sector XX's airspace on his way to the neighboring Center's airspace. I debated for a moment in my head whether to point him out to XX (and hand off to the neighboring Center) or hand him off to XX. My R Controller looked at me, pointed to the BE10 and said, 'XX's watching him.' I nodded, and flashed the hand off to the neighboring Center. … He asked me if they had ever gotten the point out on him. I was confused and said I thought he had told me that he had pointed him out to XX. … In retrospect, I now understand that my R Controller had been asking me a question: 'XX's watching him?' I would recommend, as a Radar Associate, if you believe your R is telling you that he already coordinated something, to question it and to reiterate to clarify that that is what he is actually telling you."*

  Although the conversation between the R-side and the D-side did not take place on a recorded line, the 'non-standard' Phraseology created ambiguous communication between the controllers. [CC02d]

Now that you have reviewed the most common types of aircraft actions and communications factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Aircraft Actions and Communications Conditions

Review the de-identified sample narratives below. Determine if the factor being described is an aircraft action or a communication condition. Then determine which AirTracs factor from the aircraft actions or communication is being described. For this exercise reference the tables below:

Possible Aircraft Actions are:		
Deviation	Pilot does not comply with published procedures or ATC instructions A. Procedures B. ATC Instructions	 AA01a AA01b
Unexpected Aircraft Performance	Aircraft performs in an unanticipated manner	AA02
Aircraft Equipment / System Operation	Equipment problems affect aircraft performance	AA03
Responding to Abnormal Situation	Onboard issues affect aircraft performance	AA04
Go Around	Aircraft aborts landing	AA05
Flight Planning	Pilot departs on improper route or with inadequate preparation	AA06
TCAS RA Response	Reacting to a TCAS alert	AA07
Possible Communication Factors are:		
Controller-Cockpit Communication	Controller-to-flight crew communication (verbal or written) A. Readback / Hearback B. Phraseology / Call Sign C. Information / Clearance D. Frequency Congestion E. Responsiveness	 CC01a CC01b CC01c CC01d CC01e
Controller-Controller Communication	Controller-to-Controller communication (verbal or written) A. Position Relief Briefing B. Handoff / Point Out C. Aircraft Information D. Phraseology	 CC02a CC02b CC02c CC02d

1. *"I observed N###KK descending through FL231 to make the ABCDE1 restriction, then I issued JBU### FL240. JBU### started a descent. About thirty seconds later, N###KK climbed back to FL234. I advised N###KK that he must continue descent and not climb. N###KK acknowledged my transmission, and about thirty seconds later declared an emergency."*
2. *"ASQ was cutting across arrival traffic and needed to descend. R-side vectored him off course to avoid numerous metro inbounds. I was training D-side developmental. We pointed ASQ [out] to sectors XX and YY. Went on to do other coordination, and did not notice that*

ASQ was descending very slowly and needed a point out to the neighboring center's sector ZZ."

3. *"I noticed a C182 had pushed their airplane out from their parking spot. The plane came right up to taxiway Alpha but it was not crossing the line at the time. I then looked to see if the pilot was in the airplane already and noticed them start their engine. Without calling ground control, the C182 taxied all the way onto taxiway Alpha and stopped in the middle of it. I reached out to the pilot twice and I did not receive an answer. I tried again a third time and the pilot finally came back with an answer, saying that they were ready for taxi…I gave the pilot taxi instructions and then advised them 'possible pilot deviation, call the tower, advise when ready to copy the tower number.'"*
4. *"He asked me what speed I wanted and I told him it was his discretion. The B747 decided to go around on short final, and was instructed to turn left heading 220 at 2,000 and the B767 at 3,000 on runway heading. The B747 went around at the last minute."*
5. *"The Cherokee was getting close to the Center boundary. He was at 5 thousand. This is an area where we have good radar coverage but Center's is spotty. I finally called the Center about the handoff and they said, "Keep him coming." I should have asked him if he wanted me to spin him or terminate radar, but usually they'll grab the handoff in a couple of miles."*
6. *"I scanned the RWY and cleared DAL for takeoff, with instructions to "RNAV TO ABCDE". DAL responded quickly, yet completely, with "CLEARED TO ABCDE" and his call sign…later I observed DAL in a hard right turn. I transmitted "DAL TURN LEFT IMMEDIATELY". DAL acknowledged and the aircraft rolled left into the turn. I asked DAL to verify if he was going to "RNAV TO ABCDE" and he replied in the affirmative with his call sign… I continued to observe the target on the RACD and saw he had not continued south towards ABCDE, but upon looking out the window, saw he had leveled his wings after switching to departure and was tracking straight out again… After observing the incorrect turn, I should have given DAL a 240 heading to ensure no issues with flying towards ABCDE, as I later found out that DAL said he was having FMS problems."*
7. *"There was an a/c flashing at us out of about FL200 with FL320 in the data block. We looked at the flash. My trainee did a traffic search and determined that the a/c be stopped off at FL300 for traffic. As we were making the call to high sector, the R-side took the handoff because the a/c was already thru FL250 in our shelf and no one was calling us for a handoff or to apreq an altitude with us even though he was in our airspace now. We called high sector to have the a/c stopped off. They said they had taken a point out from low sector. So the low side pointed out the a/c to their high side, but did not apreq an altitude with us as he busted up through the bottom of our airspace. We told them to stop the a/c off and he said he had already switched him to us. He did come over and the R-side stopped him off and averted an operational error. I don't think the low sector even realized that he had busted our airspace because of the shelf out there. He actually called our low side sec XX for a point out thru the shelf. That may be why he never called us for the handoff."*
8. *"I was training a CPC at combined high altitude sectors. She took a handoff on N###LC climbing to FL330. After taking the handoff, the controller giving her the handoff stated that*

N###LC was non-RVSM. Apparently he had filed the wrong equipment suffix. Once we spoke to N###LC, we verified with him that he was non-RVSM and changed his code from a /L to a /G."

9. *"The aircraft was issued a clearance to descend via the STAR. The pilot acknowledged the clearance with a readback, but did not continue his descent."*
10. *"The Pilatus requested lower for arrival without being specific as to desired altitude. I said, 'Okay, so how about down to twenty for right now?' to which the Pilatus replied, 'Perfect.' While I was calling to point out the Pilatus descending to FL200, I noticed that he had left FL240. I told him to return to FL240…shortly afterwards, the point-out was approved…I should have said, 'Expect descent to FL200 shortly…' or something similar."*
11. *"I continued to observe the sector and noticed PR-D## turning to the southeast, instead of what I thought he was going to do which is proceed southbound…The CPC-IT called the a/c 'Presidential' and issued a climb to avoid an occurrence but that a/c never responded because he wasn't a 'Presidential.' At this point, I called the CJC and tried to give a visual clearance but the a/c responded that he was getting a TCAS alert and was climbing. PRD## also responded to a TCAS alert and descended."*
12. *"The Cessna was released on a VFR departure with an IFR pick up in the air. I told him turn LEFT headed 090 cleared for immediate takeoff due to an airshow aircraft on 2 mile final. The pilot read back Right to 090 and I didn't catch that... as soon as I saw him begin a right turn, I instructed him to turn left."*
13. *"I was instructing a CPC-IT on a combined sector. No D-side. Heavy traffic and heavy complexity due to WX causing widespread deviations. Much frequency congestion. Many pilot requests for route changes or deviations for weather. I could tell the trainee was getting overloaded…"*
14. *"The WJA was on a direct route and had asked to deviate 20 degrees right of course for weather. I approved this deviation and immediately let the neighboring sector know since it would impact their airspace and I had also let the adjacent Center sector know since they had the handoff. After this coordination I switched comms to them and kept working. I later realized that WJA had went into a different Center's sector airspace and I had not made a point out to them. I should have immediately pointed that aircraft out to the other Center and I should have asked the pilots of the WJA how far they needed to deviate."*
15. *"We were vectoring and descending arrivals. AAL came over on a 305 heading at FL300. I turned AAL back to the right and descended to FL290. There were other data blocks covering limited aircraft and I did not see that there was another aircraft at FL300 parallel to the arrival. Because we have control for turns and descent of aircraft, my turn of AAL and his slow rate of descent caused him to come within 5 miles of AWE. AAL was expedited but was only 700 feet below when conflict alert activated. The heading portrayed in the 4th line indicated to us that it was for spacing and not for traffic. We had previous traffic all on headings and displayed in the 4th line. This aircraft was no different. If indeed the heading was for traffic we should have been informed as to not turn the aircraft."*

AirTracs Practice Quiz Answers: Airport Actions and Communication Conditions

1. N###KK behaved erratically due to an engine flameout – an emergency. This factor is classified as Responding to Abnormal Situation. [AA04]
2. Because the ASQ descended at a much slower rate than either controller expected, this is Unexpected Aircraft Performance. [AA02]
3. The Cessna was taxiing in a non-movement and movement area and was not responding to the tower controller. This non-communication would be classified as Controller-Flight Deck Communication – Responsiveness. [CC01e]
4. The B747 initiated a Go Around. [AA05]
5. Even though many controllers use the phrase "Keep him coming," it is not proper Controller-Controller Communications – Phraseology. [CC02d]
6. DAL did not fly the proper SID routing because of an equipment malfunction. DAL should have reported the problem as soon as they became aware of it. The aircraft FMS problems would be classified as an Aircraft Equipment / System Operation factor. [AA03]
7. The OJTI on the D-side reported a situation where their airspace is violated by an aircraft in potential conflict with another aircraft the sector is working. The situation became more confusing because the controllers have to determine which sector is talking to the aircraft. This is a Controller-Controller Communication issue with Handoff / Point Out. [CC02b]
8. N###LC filed the wrong equipment suffix, which would be classified as a Flight Planning factor. [AA06]
9. The controller issued a clearance, and the pilot correctly read back the clearance. However, the pilot did not follow the procedure, which would be classified as an Aircraft Deviation from ATC Instructions / Clearance. [AA01b]
10. The controller did not use proper phraseology. He could had asked the Pilatus to say requested altitude, or he could have just said 'stand by' and picked an altitude that provided an operational advantage and avoided the whole situation. This factor would be classified as Controller-Cockpit Communications – Phraseology / Call Sign. [CC01b]
11. While there are many factors being described in this narrative, the CJC and the PR-D## receiving and responding to TCAS alerts would be classified as TCAS RA Response. [AA07]
12. The Cessna read back the wrong direction and the controller did not catch the incorrect readback. This issue would be classified as Controller-Cockpit Communication – Readback / Hearback [CC01a]
13. There are many factors that should be classified with other AirTracs factors. When examining Controller-Cockpit Communications, the controller is describing Frequency Congestion. [CC01d]

14. The controller approved a deviation for the aircraft, but there was not clear communication from the flight deck on how long they would deviate. Also, the controller did not place a restriction on the deviation contributing to this airspace violation. These Controller-Cockpit Communication issues would be classified as Information / Clearance. [CC01c]
15. While there are many factors to be classified, the controllers were communicating via the 4th line. If the 4th line indicated the heading was due to traffic, or if the previous controller had explained the heading, then the Controller-Controller Communication regarding the Aircraft Information would not need to be classified. [CC02c]

CONTROLLER READINESS

Controller Readiness factors describe the mental and physical conditions of the controller impacting human performance. Controller Readiness is classified as cognitive and physiological factors and knowledge / experience factors.

Figure 12: Controller Readiness

Cognitive and Physiological Factors

Cognitive and Physiological factors refer to the cognitive or mental conditions of the operator and refer to the physiological or physical conditions of the operator.

Working Memory / Distraction

A controller's memory is impacted, or a controller is distracted impacting performance. [CPF01]

Workload

The workload is too demanding or is too low for adequate levels of controller engagement. [CPF02]

a. High Workload [CPF02a]
b. Low Workload [CPF02b]

Complacency/Vigilance

A controller has developed complacency towards a task impacting performance. A controller's level of vigilance is impacting performance. [CPF03]

Tool Reliance

A controller becomes reliant on automation or tools impacting performance. [CPF04]

Expectation Bias

A controller's expectations regarding automation performance or aircraft movement are not met or are exceeded impacting performance. [CPF05]

Fatigue

A controller suffers from mental, physical, or task fatigue impacting performance. [CPF06]

Time Pressure

A controller feels pressured to complete a task in a certain amount of time. Time pressure may be internally or externally motivated. [CPF07]

Knowledge/Experience Factors

Knowledge / Experience Factors refer to the experience or knowledge level a controller has for a task, procedure, or policy that results in an unsafe situation.

On-the-Job Training/Developmental

A certified controller is conducting on-the-job training or a developmental controller is participating in on-the-job training. [KE01]

Trainer Intervention

A certified controller conducting on-the-job training intervenes or does not intervene in developmental performance / training. [KE02]

CPC Experience

A certified professional controller's experience level (high or low) impacts performance. [KE03]

Unfamiliar Task/Procedure

A controller lacks familiarity or experience with a new or novel task, procedure, or policy. [KE04]

Tip for Classification

CPC Experience refers to a controller who was recently certified on a position. The CPC encounters a relatively routine task, but since the CPC is new, the CPC may lack the experience to adequately respond to the task. Unfamiliar / Task Procedure refers to a non-routine task, such as special TFR and ALTRV.

Controller Readiness Examples

Take a look at the following examples for factors in the Controller Readiness group:

- *"At the time, my developmental and I were coordinating an aircraft that was not an emergency but had a sick flight attendant that needed priority. This diverted our attention away from the slow moving overflight and the departures."*

  When examining Cognitive and Physiological factors, the controller described how the D-side team was distracted by work related duties. Additionally, OJT was occurring. These factors would be classified as Working Memory / Distraction and OJT / Developmental. [CPF01 and KE01]

- *"The session saw a large number of weather deviations with many point outs and coordination. We were also in the midst of shutting off the neighboring Center due to weather."*

  This is an example of high workload [CPF02a]. (Remember that at times, low workload can also be a controller readiness factor – CPF02b).

- *"A few minutes later, conflict alert went off between the two. I was complacent in recognizing this as conflict alert goes off with around 50% of aircraft in the particular area. I proceeded to continue working other aircraft. Approximately one minute later, the AWI advised me that he had an RA…"*

When examining Controller Readiness, the controller reported being complacent in responding to the conflict alert, which would be classified as Complacency / Vigilance. [CPF03]

- *"The P180 was en route to enter approach alpha sector at 070. I flashed the a/c id to "p" and automation is supposed to direct it to proper sector. I then became distracted doing a lengthy point out and handoff process for a military departure that was in my airspace very briefly. When that was resolved I noticed the P180 had entered approach airspace without the handoff being accepted. As I was calling them I saw the automation had directed it to wrong sector in approach. The correct sector called radar contact. I then manually directed handoff to their sector and they accepted it."*

  The controller assumed automation would hand the aircraft off to the correct sector inside approach. The controller did not identify the problem until after the airspace violation had occurred. While the inadequate monitoring is an Operator Act factor, the Tool Reliance contributed to the mistake. [CPF04]

- *"The Falcon was 10 miles away and ground speed was only 229. I ran vector lines out and plenty of room so I gave the Baron his crossing restriction on the star. Within 2 miles the Falcon was already out of 154 and was doing almost 350 ground speed. I wasn't expecting him to go almost straight up or so fast so quickly. I never thought they would be less than the 10 miles apart."*

  The controller reported not "expecting him to go almost straight up or so fast so quickly." This factor would be classified as Expectation Bias. [CPF05]

- *"I moved over to relieve controller coming up on 10 hours while I was over 2h on position...in the future I won't combine a sector when I am that tired."*

  While there are staffing issues and other related factors being reported, the controllers were experiencing Fatigue. [CPF06]

- *"I was D-side training at the time of the event."*

  While it may be unclear if training impacted the safety event, OJT was occurring at the time and should be classified as an observed factor. [KE01]

- *"He climbed slower than expected and crossed overhead of FL310 traffic at FL316. I attempted to make the trainee aware of the situation. I was not aggressive enough in suggesting action when I realized it wasn't going to work."*

  The controller described the aircraft's climb as "slower than expected," which would be classified as Expectation Bias. The controller also identified his inadequate Trainer Intervention as impacting the situation. [CPF05 and KE02]

- *"I knew it would be close but I thought it would be 7miles apart by the time they converged. The angle on the UAL flight and the increasing speed on the other flight caused a possible separation loss at FL190. This was the first day I had worked this sector alone since being checked out 5 days ago."*

  This was the CPC's first time working the sector alone, which would be classified as CPC experience. [KE03]

- *"During this time, there was also some question about special routes that were being used for a special event. There was a D-side developmental training who had just sat down when this happened. We were disusing these non-standard routes. "*

A special event was occurring that resulted in non-standard special routes, which would be classified as Unfamiliar Task/Procedure. [KE04]

Now that you have reviewed the most common types of controller readiness factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Controller Readiness

Review the de-identified sample narratives below. Determine if the factor being described is a cognitive and physiological or knowledge / experience factor. Then determine which AirTracs factor from controller readiness is being described. For this exercise reference the tables below:

Possible Cognitive and Physiological Factors are:		
Working Memory / Distraction	A controller's memory is impacted, or a controller is distracted	CPF01
Workload	The workload is too demanding or is too low for adequate levels of controller engagement	CPF02
Complacency / Vigilance	Controller's vigilance level	CPF03
Tool Reliance	Controller becomes reliant on automation or tools	CPF04
Expectation Bias	Controller's expectations regarding automation performance or aircraft movement	CPF05
Fatigue	Mental, physical or task fatigue	CPF06
Time Pressure	Controller feels pressured to complete a task	CPF07
Possible Knowledge / Experience Factors are:		
OJT / Developmental	OJT is occurring	KE01
Trainer Intervention	OJTI conducting on-the-job training intervenes or does not intervene in training	KE02
CPC Experience	Certified professional controller's experience level (high or low)	KE03
Unfamiliar Task / Procedure	Controller lacks familiarity or experience with a new or novel task, procedure, or policy	KE04

1. *"I was working my second midnight shift in a row. I wasn't able to get much sleep before my shift."*
2. *"D-side training was also taking place and the trainee had very little time on the position."*
3. *"… The new OPD arrivals had been implemented 3 days prior."*
4. *"As the situation developed conflict alert initiated and it was apparent that the Developmental's plan wasn't working. I seized the frequencies and told the FLG that we need him level in about 30-45 seconds. Then I issued the traffic, which he reported 'in sight.' I then climbed the UAL a thousand feet give him more room if nothing else. As he was one hit outside the J-ring indicating FL298 I asked him to confirm that he was level at FL290 and he answered 'affirmative.'"*
5. *"The Supervisor was trying to help by pointing on the scope who needed reroutes, etc., I think it just made us the R-side more distracted and flustered."*

6. *"I have less than 20 hours of experience at the sector after certification. It is a new sector, as a result of the airspace redesign."*
7. *"This situation stemmed from a lapse in my traffic scan. My recommendation would be to do whatever one can to keep a strong scan, as a situation like this can happen anytime. Case in point, light, non-complex traffic can be a breeding ground for potential OE's."*
8. *"I was expecting the B737 to stay in front of the Citation. The B737 had been vectored off the airway by the previous sector and took a harder turn to get back on the airway then I expected."*
9. *"When I rerouted the Airbus direct to next fix it inhibited the auto handoff. As a result, the date block did not handoff to the next center. I didn't notice it until the aircraft was on the boundary."*

AirTracs Practice Quiz Answers: Controller Readiness

1. This controller reported not being able to get enough sleep, which would be classified as Fatigue. [CPF06]
2. The occurrence of OJT / Developmental would be classified. [KE01]
3. In this case, both for the controllers and the flight crews were introduced to new procedures, which would be classified as an Unfamiliar Task/Procedure. [KE04]
4. While OJT was occurring, the main factor impacting performance in a positive manner is Trainer Intervention. The developmental was able to learn from the situation while still ensuring safety. [KE02]
5. The supervisor thought he was being helpful but was actually hindering the R-side from developing his mental model, which would be classified as Working Memory / Distraction. [CPF01]
6. A CPC recently certified at a sector is classified as CPC Experience. [KE03]
7. The controller reported the traffic level being light, which created a Low Workload situation. This also impacted the controller's level of Vigilance. [CPF02b & CPF03]
8. The controller assumed that the previous controller put the B737 on a gentle vector to rejoin the airway and that the B737 would execute that without taking any steps to ensure separation. This would be classified as Expectation Bias. [CPF05]
9. The controller does not explain why he did not make a handoff entry for the Airbus, but he did expect the auto handoff function to take care of it, not realizing that the direct reroute had inhibited it. This would be classified as Tool Reliance. [CPF04]

FACILITY INFLUENCES

Facility Influences factors are those factors in a safety event describing the methods, decisions, or policies of the facility management. Facility Influences factors also include the actions of the traffic management unit that impact controller performance or operations. Facility Influences are classified as supervisory planning / preparation, supervisory operations, or traffic management.

Figure 13: Facility Influences

Supervisory Planning / Preparation

Supervisory Planning / Preparation refers to the planning and preparation of operations conducted by facility management that impact controller performance or operations.

Facility Procedure

A facility procedure is inadequate, out-of-date, does not exist, or, conversely, is helpful impacting controller performance.

a. Standard Operating Procedure [SP01a]
b. Letter of Agreement [SP01b]
c. Checklist / Manual [SP01c]

Staffing

The facility staffing or staffing schedule impacts controller performance or operations. [SP02]

Facility Equipment

The facility equipment or automation is inadequate, out-of-date, or does not exist impacting controller performance. [SP03]

Training

Facility training for controllers on automation or procedures is inadequate, out-of-date, does not exist, or exceeds expectations impacting controller performance. [SP04]

Supervisory Operations

Supervisory Operations Factors refer to the day-to-day operations and tasks conducted by facility management that impact controller performance or operations.

Sector Combination

Supervisor de-combines or combines sectors impacting controller performance. [SO01]

Position Combination

Supervisor de-combines or combines positions impacting controller performance. [SO02]

Controller Assignment

The supervisor's controller position assignment or rotation schedule impacts controller performance. [SO03]

Oversight / Assistance

A supervisor does or does not provide an adequate level of strategic oversight or assistance to controllers. [SO04]

Sector/Airport Configuration

A supervisor changes or does not change sector or airport configuration impacting controller performance or operations. A supervisor enacts sector flow or airport configuration impacting controller performance or operations. [SO05]

Supervisory Coordination

A supervisor's coordination with traffic managers, other supervisors, or other facilities impacts controller performance.

a. Intra-Facility [SO06a]
b. Inter-Facility [SO06b]

Traffic Management

Traffic Management Factors refer to the operations of the traffic management unit and their impact on the controller performance and operations.

Weather Response

The TMU's response to weather conditions impacts controller performance or operations. [TM01]

Special Use Airspace

The activation, deactivation, and communication of special use airspace impacts controller performance or operations. [TM02]

Traffic Management Initiatives

The TMU issues traffic management initiatives impacting controller performance or operations. [TM03]

Traffic Regulation / Delivery

TMU regulates delivery of airport or sector traffic, which impacts controller performance or operations. [TM04]

Facility Influences Examples

Take a look at the following examples for factors at the Facility Influences Tier:

- *"The SOP states arrivals shall be issued 20S VOR/XSCTN at FL190. This can be read as 20s of VOR @ FL190 or XSCTN at FL190 or 20S XSCTN at FL190. Someone not familiar with the airspace (me) could misinterpret the SOP, as happened in this case."*

  The controller reported that SOP is ambiguous, which would be classified as Facility Procedures – SOP. [SP01a]

- *"The Center / Approach letter of agreement states that any aircraft not able to fly the RNAV departure out of the West gate will be on a 290 heading with no coordination. The airspace and*

aircraft adversely effected by this are several pieces of restricted airspace and the Northwest arrival gate."

This controller reported issues with a new LOA, which is classified as Facility Procedures - LOA. [SP01b]

- *"Upon reporting for duty, I learned that our staffing for the night shift was at a critically low level even with people on overtime… Twice I requested a D-Side and was told that there were no available controllers to assist me."*

  The Staffing was low impacting operations. [SP02]

- *"ERAM was being utilized and no track was started due to tracking issues associated with ERAM...Recommendation: there are some associated tracking issues that need to be addressed with ERAM tracking before being utilized."*

  The controller reported facility-wide issues with automation that impacted controller performance, which would be classified as Facility Equipment. [SP03]

- *"We also need some refresher training on the L-side position, even though the L-side I got was a CPC I had to show him where to plug in and how to split mode the sector. We work one-man sectors 99% of the time and very little L-side time. So while working deviating traffic, I had to tell the sup about the deviations and recommend routes, request a L-side, then a D-side and help the L-side get plugged in correctly. All these things take my attention away from the scope."*

  The controller reported the need for more refresher training on L-side position and describes how the lack of training impacted controller performance, which would be classified as Training. [SP04]

- *"I requested a split and received no response from CIC. A second Controller requested to split and was told by CIC, 'They will be fine.'"*

  The CIC did not split the positions for the two controllers, which would be classified as Position Combination. [SO02]

- *"The FLM put us on L-side, but neither of us have had L-side training."*

  The FLM assigned the controllers to a task for which they were not trained, which would be classified as Controller Assignment. [SO03]

- *"I returned from break and found several people training on D-sides and only 3 controllers in the break bay with 7 sectors open…several minutes later the FLM came over and asked if I would take the low altitude sector underneath mine...I didn't want to but the FLM said that traffic wasn't predicted to pick up for a while…Traffic slowly increased until I began missing calls and fell behind. One of the other controllers finally got the FLM's attention…The FLM was sitting behind the desk the whole time. The FLM acted surprised when they walked over to my scope and saw the traffic. I had over 35 in the aircraft list and about 20 on the freq."*

  In addition to other factors, the FLM made a decision based on predicted sector traffic, but then does not provide the correct level of oversight to monitor the predicted traffic level. This would be classified as Oversight / Assistance. [S004]

- *"The FLM instructed us to land Runway XXR, and depart Runway YY at the same time. This was a potentially unsafe operation due to the fact that if a Runway XXR lander had to go around...they would have been placed in a very unsafe situation with the RWY YY departure"*

  The controller described how the airport configuration might impact operations during a potential safety event. The supervisory decision-making associated with the airport configurations would be classified as Sector / Airport Configuration. [SO05]

- *"Aircraft reported debris on the runway, city notified, closed the runway. City vehicle went out on the runway, picked up the debris and reported clear and said that operations were calling to open the runway. The Supervisor left the Tower, without closing the [coordination] loop, [about] getting the runway back open… [The relieving supervisor was] calling the city to get the current [runway] status. I am not entirely sure that the relieved Supervisor was aware that it was still closed."*

  The supervisor left the tower without coordinating with surrounding facilities regarding the runway status, which would be classified as a Supervisory Coordination – Inter-Facility. [SO06b].

- *"I was working at sector X when the airport went into holding due to weather… If the satellite airport departures were routed to the west during holding there would have not been such a small gap for all the aircraft to fly through and no loss of separation would have happened. TMU did nothing to start slowing the aircraft back."*

  The TMU reaction to the weather allowed a traffic bottleneck to occur, which would be classified as Weather Response. [TM01]

- *"Because the MOA was hot we didn't have many options [for routing during a big push]."*

  The controller described how special use airspace limited the controller's ability to route aircraft through the preferred airspace, which would be classified as Special Use Airspace. [TM02]

- *"In addition, the arrivals I was working had to be issued an additional reroute to a different transition for the arrival. So each arrival I was receiving had just been issued bad routing by which I then had to fix… A B757 was at FL300 on routing that took him direct to an intersection within the confines of a restricted area, which is used for live-fire exercises. This area was hot SFC-FL300. The next sector noticed the B757 heading toward the restricted area and asked me if he had been pointed out. He took care of the point out while I climbed the B757."*

  TMU is responsible for creating Traffic Management Initiatives. In this event, the TMI created inadequate routing that had to be fixed by the controller. This TMI factor is attributed to Traffic Management Initiatives. [TM03]

- *"[TMU let us get to where] we had 23 aircraft in the sector at the time of the occurrence."*

  The controller reported that TMU's actions impacted the controller having a large number of aircraft in the section, which would be classified as Traffic Regulation / Delivery [TM04].

Now that you have reviewed the most common types of facility influences factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Facility Influences

Review the de-identified sample narratives below. Determine if the factor being described is supervisory planning / preparation, supervisory operations, or traffic management. Then determine which AirTracs factor from the facilities influences tier is being described. For this exercise reference the tables below:

Possible Supervisory Planning / Preparation Factors are:		
Facility Procedures	Facility procedure is inadequate, out-of-date, does not exist, or, conversely, is helpful A. Standard Operating Procedure B. Letter of Agreement C. Checklist / Manuals	SP01a SP01b SP01c
Staffing	Facility staffing level or schedule	SP02
Facility Equipment	Facility equipment and automation	SP03
Training	Facility training for controllers on automation or procedures	SP04
Possible Supervisory Operations Factors are:		
Sector Combination	Supervisor combines or de-combines sectors	SO01
Position Combination	Supervisor combines or de-combines positions	SO02
Controller Assignment	Supervisor's controller position assignment or rotation schedule	SO03
Oversight / Assistance	Supervisor strategic oversight or assistance to controllers	SO04
Sector / Airport Configuration	Supervisor enacts or does not enact sector or airport configuration change	SO05
Supervisory Coordination	A supervisor's coordination with others actors A. Intra-Facility B. Inter-Facility	SO06a SO06b
Possible Traffic Management Factors are:		
Weather Response	TMU's response to weather conditions	TM01
Special Use Airspace	TMU's activation, deactivation, and communication of special use airspace	TM02
Traffic Management Initiatives	TMU issues or does not issue traffic management initiatives	TM03
Traffic Regulation / Delivery	TMU regulates delivery of airport or sector traffic	TM04

1. *"This radar sensor has a lot of issues with dropping tags and going off line. The management was aware of the issue but no actions to fix the sensor have been taken."*

2. *"A COL4 was IFR inbound landing. The COL4 requested the RNAV Runway XX into the airport. ATC cleared the COL4 unaware the runway was closed. The pilot landed and called the TRACON facility to ask why he was cleared into the airport on a closed runway. All the controllers involved, including the pilot, were unaware of the runway being closed. The NOTAM for the runway closure was indeed on the NOTAMS page just hard to see so it was overlooked. There was no accident that was involved in this error. I think who ever received the notice of the airport closure should have made it easier to read and well known for everyone. If there were a visible notation on the RADAR position, I feel this would not have happened."*
3. *"At the time, I was also working an XXX sequence because several aircraft departed airports within my airspace at the same time, all going to XXX, plus, I had high traffic also going to XXX. It seems as though there was no regard from flow control as to when to release these aircraft, so they could be sequenced. Therefore, my workload dramatically increased. After sequencing the aircraft, I realized that ASQ had entered adjacent center airspace (without a handoff or point out)"*
4. *"Approach attempted to handoff the C414 to me. I noticed that the aircraft was about to enter and active [an] MOA and restricted area…The LOA between approach and our Center should have a provision forcing approach to route aircraft around R1234."*
5. *"I estimate that the 2 had approximately 100 FT lateral separation. This occurred [because the] Local 1 Controller allowed his arriving Cessna to descend unrestricted to cross over the field for right traffic to his Runway XXR. The Local 2 Controller had the helicopter on a transition from north to south, which put him at 1,600 FT by LOA. Recommendation: the SOP stipulates all aircraft will cross overhead at 3,000 FT, unless coordinated. I recommend that the option, through coordination, to descend aircraft crossing the field be removed from the SOP. There is no reason to take the risk of an aircraft descending through the other Local Control's airspace becoming a factor with that controller's pattern aircraft at 2,100 FT or helicopter traffic at 1,600 FT."*
6. *"The sector in the other area was trying to hand off a Lifeguard flight to us against our traffic flow. The Controller never APREQ'ed the aircraft with us…and their Supervisor never called our Supervisor to give a heads up that this aircraft was coming."*
7. *"Our normal routing was cut off because the airspace was closed at the time for a rocket launch."*

8. *"As Tower TMC I received a call from Center requesting to change a route on Air Carrier X. I considered that the first print out of Air Carrier X would be that amendment. I scanned the 3 positions in the Tower for a flight plan with that call sign and didn't see it. I may or not have notified Clearance Delivery of the impending change because of the numerous SWAPS taking place and multiple restrictions due to weather. I assume that is what was sent via PDC to Air Carrier X, which required an APREQ with TRACON for departure sequence. After Air Carrier X got airborne, TRACON TMU called and asked what flight plan had been issued to Air Carrier X. At this point I located the new flight plan sitting in Clearance Deliveries left bay with the full route sitting on top of it, which meant that it wasn't issued but the active Flight Plan in the system. So due to the demands of SWAPS, multiple APREQ's, and departure demand he got through and departed on the wrong flight plan."*
9. *"The combined sectors could have been split off by the FLM. A D-side could have been assigned to the position to relieve some of the extra workload from the Radar Controller. Or, there could have been a D-side and the sectors could have been split." [SO01]*
10. *"I was working ground during a very busy session and when it slowed down just a little I was told to take over Local Control as well. But it was known that it would be a busy day, and still there were 3 certified controllers told to go downstairs and conduct training."*
11. *"Heavy traffic and heavy complexity due to WX causing widespread deviations. Much frequency congestion. Many pilot requests for route changes or deviations for weather…the FLM was monitoring and pointed out the AWE approaching the boundary that needed to be handed off."*
12. *"The area was short on staffing, I worked a total time of 3hr 20 mins on position."*
13. *"Airspace design in the area is lacking and could be made better to help alleviate some complexity...Work groups have met in the past to discuss this but Air Traffic Management has labeled the situation an 'efficiency' issue, not a safety issue "*

AirTracs Practice Quiz Answers: Facility Influences

1. The controller described the facility management being aware of a radar sensor error, but not acting to fix the equipment. This issue would be classified as Supervisory Planning / Preparation – Facility Equipment. [SP03]
2. The controller reported issues with the way NOTAMs were disseminated at the facility, which would be classified as Facility Procedures. [SP01]
3. The controller described how an inadequate traffic regulation by TMU led to sector saturation and ultimately to an airspace violation. The traffic issue would be classified as Traffic Regulation / Delivery. [TM04]
4. The controller described an issue with the Facility LOA, which is classified as a Facility Procedures – LOA. [SP01b]
5. The controller identified an SOP that he feels is inadequate, which would be classified as Facility Procedures – SOPs. [SP01a]
6. The supervisor did not coordinate a flight that needed special attention with other supervisors within the facility, which would be classified as Supervisory Coordination – Intra-Facility. [SO06a]
7. A rocket launch led to a closure of airspace causing the controller airspace options to be constrained. This airspace factor would be classified as Special Use Airspace. [TM02]
8. A Center's Traffic Management Initiative caused confusion in the tower as reported by the narrator. The confusion over the TMI would be classified as Traffic Management Initiative. [TM03]
9. The controller reported that the FLM's actions to de-combine both the sector and the position were inadequate, which would be classified as both Sector Combination and Position Combination. [SO01 and SO02]
10. The controller reported issues with the supervisor's assignment of controllers to conduct training rather than control traffic. This issue would be classified as Controller Assignment. [SO03]
11. The controller described how a supervisor helped to assist in a situation providing the positive Oversight / Assistance. [S004]
12. The facility did not have the adequate level of staff available to avoid over-extended shifts. This planning issue is classified as Staffing. [SP02]
13. The Air Traffic Management groups are the group of supervisors responsible for determining airspace designs and configurations that work best for safety and efficiency. Here the controller is expressing issues that would be classified as Sector / Airport Configuration. [SO05]

AGENCY INFLUENCES

Agency Influences factors are those factors in a safety event describing the communications, actions, omissions, or policies of upper-level management impacting facility practices, operator context, controller performance, or operations. Agency Influences are classified as resource management, organizational climate, and operational process.

Resource Management

Resource Management factors refer to the organizational-level decision-making regarding the allocation and maintenance of organizational assets that impact operations or controller performance.

Equipment/Facility Resources

Agency-wide equipment, facility design, or facility resources impacting operations or controller performance. [RM01]

Human Resources

Agency-wide human resource functions (e.g., selection, staffing, training, procedures) impacting operations or controller performance. [RM02]

Agency Climate

Agency Climate factors refer to the organizational environment, structure, policies, and culture that impact operations or controller performance.

Culture

Unofficial or unspoken rules, values, attitudes, beliefs, or customs of an organization impacting operations or controller performance. [AC01]

Policy

Official guidelines about agency-wide policies (e.g., hiring and firing, promotion, retention, and sick leave) impacting operations or controller performance. [AC02]

Operational Process

Operational Process factors refer to the organizational process, including operations, procedures, operational risk management, and oversight that impact operations or controller performance.

Procedures / Operations

Procedures for NAS operations are inadequate, out-of-date, do not exist, or, conversely, are helpful impacting operations or controller performance. [OP01]

a. NAS Procedures (7110.65) [OP01a]
b. Charts / Routes (STAR, SID) [OP01b]

Oversight

Agency oversight to actively monitor individuals, management, or problems impacting operations or controller performance. [OP02]

Response to Event / Report

Agency response to a safety event or report is inadequate, untimely, or, conversely, is helpful, impacting operations or controller performance. [OP03]

Agency Influences Examples

Take a look at the following examples for factors at the Agency Influences tier:

- *"Every facility I've ever been to had access to emergency frequencies at all positions. Not here for some reason. They have ONE position with 121.5 available and it is on the other side of the TRACON from where I was working. Had it been available or within reach, this could have been handled better."*

  The controller describes how the facility was not provided with the resources to have more than one position with access to the emergency frequency, which is classified as Equipment / Facility Resources. [RM01]

- *"Our staffing is running at bare minimums and most times there are no bodies to help out during busy times. The facility management has been requesting higher staffing."*

  The controller reported that the facility has been requesting higher staffing levels, which would be classified as Human Resources. [RM02]

- *"Most of the responses from [that] Sector are: 'I am not watching that far south of my airspace.'"*

  The narrator reported on a general attitude that was culturally accepted among controllers in that sector, which is causing issues. This indicates a factor of Culture. [AC01]

- *"Only one sup in our area has been checked out on all the sectors and understands the impact weather deviations can have on the area. The others only do their mandatory 8 hours on one sector with little traffic and no weather, so with little to no experience with the traffic flows in our area they are unable to anticipate the problems that can arise and we end up with what we had today."*

  The controller reported issues with the current Agency policy on the training requirements for supervisors, which would be classified as Policy. [AC02]

- *"Order 7110.65, refers to the phraseology 'Hold for Release.' Better phraseology and a better operating practice is to either use the word 'HOLD' or 'RELEASED.' That phraseology would have made*

this a non-event, because you cannot mistake the word 'HOLD' for 'RELEASED,' but it is certainly possible for a Controller to say 'Hold For Release,' and the other Controller to only hear released. That has happened many times at this facility alone."

The controller provided insight into a potential issue caused by confusing phraseology specified in the 7110.65. This issue would be classified as Procedures / Operations – NAS Procedures (7110.65). [OP01a]

- *"Recommendation: This is a new route that no one was informed of and also takes them just outside of our airspace at least 3 times. This is very unusual and requires a much higher workload than what they usually do. There needs to be a sit down between military ops and ATC to figure out what they are doing and get our maps and procedures updated."*

  The controller reported issues with a new route, which would be classified as Procedures / Operations – Charts / Routes. [OP01b]

- *"I advised that it would normally be approach and they said they would probably hand the aircraft off and give control. I called the tower to see what they would do and the two people working are only tower certified and the approach controllers had already left for the night. They did not know either. The sup was not available."*

  The supervisors and the approach controllers, either of which could have provided assistance, were unavailable, which would be classified as Oversight. [OP02]

- *"Once again - and this makes the third time I've told management (and about the 12th time it has happened just to me) - aircraft filed over this intersection into TRACON are crossing the intersection higher than the clearance that was issued to them. [So far nothing has been done about this.]"*

  If an event happens a dozen times without any response from the Agency, then there is likely a factor of Response to Event / Report. [OP03]

Now that you have reviewed the most common types of agency influences factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Agency influences

Review the de-identified sample narratives below. Determine if the factor being described is resource management, agency climate, or operational process. Then determine which AirTracs factor from the agency influences tier is being described. For this exercise reference the tables below:

Possible Resource Management Factors are:		
Equipment / Facility Resources	Agency-wide equipment or facility design or resources	RM01
Human Resources	Agency-wide human resource functions	RM02
Possible Agency Climate Factors are:		
Culture	Unofficial values, attitudes, beliefs, or customs of an organization	AC01
Policy	Official guidelines of an organization	AC02
Possible Operational Process Factors are:		
Procedures / Operations	Procedures for NAS operations A. NAS Procedures (7110.65) B. Charts / Routes (STAR, SID)	 OP01a OP01b
Oversight	Agency oversight to actively monitor individuals, management, or problems	OP02
Response to Event / Report	Agency response to a safety event or report	OP03

1. *"[According to the approach plate,] the initial approach fix altitude is 2000' in the 5800' area."*
2. *"The way the tower launches these 'non-standard' aircraft is a joke. No consideration for spacing is ever built in to the sequence, or they're launched incorrectly. For instance, the majority of the non-standard departures are east off the wrong runway… I suggest the tower supervisors and CIC's receive training from the TRACON in how these non-standard aircraft affect the flow, and when it's appropriate to launch them. If the tower gives their own training, it's 'blind leading the blind' and nothing will be fixed."*
3. *"They refuse to work VFR aircraft on a constant basis. This is a systemic pattern with this area."*
4. *"Since the [new] arrival was implemented…there has been nothing but problems with [the center] taking handoffs in a timely manner from the… sector. They have always stated that it is a radar coverage problem but that they would take handoffs as soon as they could. The problem is every day that we are on a [normal] configuration. We are in danger of violating their airspace and have done it. If they can't see the datablock and we have to turn out we are in most cases too close to their boundary. They say they can't see the data blocks until the boundary. That's too late. We are already at the point of no return there."*

5. *"A remote transmitter/receiver at the XXX airport would help greatly. It's a very busy satellite airport and it needs a remote transmitter/receiver."*
6. *"While performing flight break up both me and my trainer weren't entirely sure if done correctly. Could not find information in the 7110.65 in a reasonable time to be able to make sure technique was correct. Recommendation, I would recommend that a flight break up would be easier to find in the 7110.65."*

AirTracs Practice Quiz Answers: Agency Influences

1. The Agency is responsible for providing accurate charts and routes. The issue with the approach plate would be classified as Procedures / Operations – Charts / Routes (STAR, SID). [OP01b]
2. The controller reported issues with the policy of training non-standard aircraft, which would be classified as Policy. [AC02]
3. A general attitude where everyone in that area refuses to work VFR is indicative of a Culture factor. [AC01]
4. In addition to many other factors, the controller described how the issues with the arrival procedure had been reported, but no action had been taken to fix the issue. This factor should be classified as both Charts / Routes and Response to Event / Report. [OP01a and OP03]
5. Lacking equipment, like a radio, is an Equipment / Facility Resources factor. [RM01]
6. The controller described a situation where the 7110.65's organization of information and ease of access impacted the controller. This would be classified as Procedures / Operations – NAS Procedures. [OP01a]

OUTSIDE INFLUENCES

Outside Influences factors are those factors in a safety event describing the actions or inactions of non-FAA actors or organizations not in direct coordination with an air traffic controller. The factors have the ability to impact FAA agency, facility, and controller performance. Outside Influences are classified as airline influence, military influence, contract tower influence, and other ANSPs.

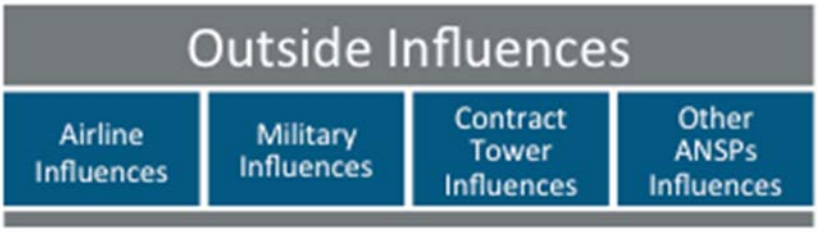

Figure 14: Outside Influences

Airline Influences

The actions or inactions of the airlines impacting NAS operations. [OI01]

Military Influences

The actions or inactions of the US military impacting NAS operations. [OI02]

Contract Tower Influences

The actions or inactions of contract towers impacting NAS operations. [OI03]

Other ANSPs

The actions or inactions of other ANSPs impacting NAS operations. [OI04]

Outside Influences Examples

Take a look at the following examples for factors at the Outside Influences tier:

- *"After I discovered the airline had two active aircraft with the same call sign, I called dispatch and they were aware of the problem and explained that the PHL bound flight was 7 hours late. He also advised that there were 3 separate legs with that [same] call sign and they changed one, but did not anticipate having to change the third."*

  The controller described how the airline assigned two active aircraft the same call sign. Since the airline is responsible for assigning call signs, this factor would be classified as Airline Influences. [OI01]

- *"As per requirement we are not allowed to take an [special military aircraft] off course unless needed for separation. I had asked my supervisor to call the watch desk about the route the [special military aircraft] was on and was told to leave him on his route. [Later a LOSS occurred because of a slow climbing flight was unable to get out of the military aircraft's way.]"*

  Here the regulations set around the special military aircraft had a significant impact on the controller's ability to provide separation. This outside influence of the Military Influences is a factor. [OI02]

- *"The contract tower controller seemed to be confused about which aircraft was sequenced next for takeoff. They cleared us, but there was another similar looking Cessna lined up waiting in front of us*

with a similar call sign. We told the controller we thought it best if the Cessna in front of us get out of the way first."

In this report, a pilot was reporting confusion at the Contract Tower. [OI03]

- *"A flight out of Canadian Airspace entered my sector without a hand off. After calling the Sector, they apologized profusely and then handed off the aircraft."*

  The Canadian ANSP is classified as Other ANSPs. [OI04]

Now that you have reviewed the most common types of outside influences factors, see how well you understand those factors by taking a short quiz. For the quiz that follows, what is important is not whether you get the right or wrong answer as much as you understand why your answer was the same as or different from the answer.

AirTracs Practice Quiz: Outside Influences

Review the de-identified sample narratives below. Determine which AirTracs factor from the outside influences tier is being described. For this exercise reference the tables below:

Possible Outside Influences are:		
Airline Influences	The actions or inactions of the airlines impacting NAS operations	OI01
Military Influences	The actions or inactions of the US military impacting NAS operations	OI02
Contract Towers	The actions or inactions of contract towers impacting NAS operations	OI03
Other ANSPs	The actions or inactions of other ANSPs impacting NAS operations	OI04

1. *"COCESNA [the central American ANSP] initiated the handoff of AM123 to our sector. The AeroMexico flight was transferred at the incorrect altitude of FL350 when the LOA said to do it at FL370."*
2. *"DAL and the other airlines have got to stop numbering flights w/ similar sounding numbers."*
3. *"I took radar on a gaggle of military aircraft swimming upstream on the southbound New York flow at various blocking altitudes."*
4. *"We need to stress to the airlines the importance of verifying the RNAV waypoints when they are issued. Rather than just repeating back what we read them, they need to verify that the FMS reads the same fix name, since each departure is runway dependent."*

AirTracs Practice Quiz Answers: Outside Influences

1. COCESNA did not adequately conduct the handoff, which should be classified as Other ANSPs. [OI04]
2. The airline's call signs were creating confusion, which should be classified as Airline Influence. [OI01]
3. The military aircraft blocked altitude needed for other traffic causing a number of problems for controllers. This outside influence should be classified as Military Influences. [OI02]
4. In this report, the controller described issues related to how airlines program RNAV waypoints. This would be classified as Airline Influence. [OI01]

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Appendix A: Classification Sheet

Operator Actions

Acts

Sensory
- Se01 Auditory Perception
- Se02 Visual Perception
- Se03 Temporal Perception

Decision
- De01 Alert Comprehension
- De02 Knowledge / Planning
- De03 Prioritization
- De04 Tool / Equipment Use

Execution
- Ex01 Controller Technique
- Ex02 Attention Act
- Ex03 Communication Act
- Ex04 Inadvertent Operation

Violation

Willful Violations
- V01 Willful Violations
- V02 Situation Induced Violation

Outside Influence

- OI01 Airline Influences
- OI02 Military Influences
- OI03 Contract Towers Influences
- OI04 Other ANSPs Influences

Operator Context

Controller Workspace

Physical Environment
- PE01 Workstation / Work Area
- PE02 Lighting
- PE03 Noise Interference
- PE04 Vision Restricted

Technological Environment
- TE01 Communication Equipment
- TE02 Display / Interface
- TE03 Software / Automation
- TE04 Warnings / Alerts
- TE05 Data Block
- TE06 Flight Progress Strips
- TE07 Field Equipment

Controller Readiness

Cognitive and Physiological Factors
- CPF01 Working Memory / Distraction
- CPF02 Workload
  - a High Workload
  - b Low Workload
- CPF03 Complacency / Vigilance
- CPF04 Tool Reliance
- CPF05 Expectation Bias
- CPF06 Fatigue
- CPF07 Time Pressure

Knowledge / Experience
- KE01 On-the-Job Training/Developmental
- KE02 Trainer Intervention
- KE03 CPC Experience
- KE04 Unfamiliar Task/Procedure

NAS Interactions

Airport Conditions
- APC01 Combined Positions
- APC02 Ground Vehicle Traffic
- APC03 Aircraft Traffic
- APC04 Airport Weather
  - a Visibility / IMC
  - b Wind
  - c Other Weather
- APC05 Signage/Lighting/Ground Markings
- APC06 Construction
- APC07 Layout/Design
- APC08 Runway Conditions

Airspace Conditions
- ASC01 Combined Sectors
- ASC02 Combined Positions
- ASC03 Sector Traffic
  - a Traffic Level
  - b Traffic Complexity
  - c VFR Traffic
  - d Restricted Airspace
- ASC04 Sector Weather/Turbulence
- ASC05 Sector Design

Aircraft Actions
- AA01 Deviation
  - a Procedures
  - b ATC Instructions / Clearance
- AA02 Unexpected Aircraft Performance
- AA03 Aircraft Equipment/System Operation
- AA04 Responding to Abnormal Situation
- AA05 Go Around
- AA06 Flight Planning
- AA07 TCAS RA Response

Communication
- CC01 Controller-Cockpit Communication
  - a Readback / Hearback
  - b Phraseology / Call Sign
  - c Information / Clearance
  - d Frequency Congestion
  - e Responsiveness
- CC02 Controller-Controller Communication
  - a Position Relief Briefing
  - b Handoff / Point Out
  - c Aircraft Information
  - d Phraseology

Facility Influences

Supervisory Planning / Preparation
- SP01 Facility Procedures
  - a SOPs
  - b LOAs
  - c Checklists / Manuals
- SP02 Staffing
- SP03 Facility Equipment
- SP04 Training

Supervisory Operations
- SO01 Sector Combination
- SO02 Position Combination
- SO03 Controller Assignment
- SO04 Oversight / Assistance
- SO05 Sector/Airport Configuration
- SO06 Supervisory Coordination
  - a Intra-Facility
  - b Inter-Facility

Traffic Management
- TM01 Weather Response
- TM02 Special Use Airspace
- TM03 Traffic Management Initiatives
- TM04 Traffic Regulation / Delivery

Agency Influences

Resource Management
- RM01 Equipment/Facility Resources
- RM02 Human Resources

Agency Climate
- AC01 Culture
- AC02 Policy

Operational Process
- OP01 Procedures / Operations
  - a NAS Procedures (7110.65)
  - b Charts / Routes (STAR, SID)
- OP02 Oversight
- OP03 Response to Event / Report